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Executive Summary

Austria is one of the smaller EU Member States, accounting for less than 1.7% of the population of the EU-27. The country belongs to the richest EU Member States, with a GDP per capita of €34,120 in 2010. The economic development of Austria in the last three years has also constantly been above the EU average. Real GDP growth in 2011 is expected to be around 3.3%. Austria was also less strongly affected by the financial crisis and has been able to recover faster than most other EU countries.

In the last two decades, Austria has managed to catch up impressively in its performance in RTDI. Although the government has declared the catching-up process of the past decades to be successfully completed, the next step towards becoming an innovation leader is still far from being realised.

On the R&D input side, Austria belongs to the EU countries with the highest GERD/GDP rate, which was 2.76% in 2010. However, the last three years have not shown a new impetus, but rather a conservation of achievements from the past. The financial and economic crisis and the resulting requirements for consolidating public budgets have revealed structural deficits which were hidden beneath the “fire signal” of growing R&D expenditures in the years before. Under pressure by the need to consolidate the public household, R&D policy since 2009 has focused on increasing the efficiency of the system (or of its core elements) rather than on expanding measures on the input side.

Nevertheless, to counteract the growth break of the corporate sector in 2009, the share of public spending on overall research financing increased by seven percentage points to 35% between 2007 and 2010.

In order to reduce the yearly overall public household deficit to 2.5% in 2013, a cost saving package is currently being planned which should become effective as of May 2012. Presumably, education, R&D and innovation are considered priority policy fields that will be least impacted by consolidation measures. Nevertheless, it is very likely that the track record of growth in recent years in public R&D spending cannot be sustained during this phase of consolidation (Austrian Government 2011). This leads to the assumption that it will be very difficult to achieve the ambitious goals indicated in the government’s RTDI Strategy, which was only published as recently as in March 2011. Among the supply-side structural bottlenecks for growth, the following - roughly summarised - challenges exist (Ederer and Janger, 2010):

1. *a weak human capital basis for innovation;*
2. *a low number of research conducting enterprises and a strong concentration of R&D expenditure;*
3. *improvable quality of university research and low volume of basic research;*
4. *competition bottlenecks;*
5. *deficits in labour participation* concerning the labour quota of the elderly and of migrants, and low qualification of persons with a migration background.

On the demand side, the following structural bottlenecks exist:

6. *private demand weaknesses* concerning domestic private demand (both in terms of investments and private consumption) and low export orientation towards emerging countries.

In the government's RTDI Strategy launched in 2011, a substantial number of these structural challenges have been actively addressed, but a few challenges have not been highlighted in the strategy:

- first of all there is no roadmap with budgetary indications and responsibilities, which would be required to implement the activities proposed in the strategy;
- research in the social sciences is taken into account to an insufficient extent;
- consideration of the grand/societal challenges in RTDI funding is still expandable;
- the R&D internationalisation portfolio lacks critical mass;
- there is little emphasis on impact evaluations of RTDI interventions, despite a well-developed RTDI evaluation culture;
- evaluation of research institutions is missing or is only relatively "light".

Regarding the policy mix, well-known structural deficits, such as lack of venture capital, remain, as evidenced by the IUS 2010. Most of these deficits, however, are at the focus of public interventions.

As regards the establishment of new indigenous R&D performing firms, several efforts to improve risk capital formation to generate positive economic effects on economic growth, on employment, and on reducing existing structural deficits, are among the most recent activities. Although the environment for creating and supporting entrepreneurial behaviour has become more favourable, general deficits remain, such as the absence of modern, internationally competitive private-equity law¹, complex bureaucratic requirements for de-investments due to the necessity to establish a "Mittelstandsfinanzierungs-AG"² (medium-sized businesses financing joint stock company), or the absence of role-models (profitable funds as success stories for other investment companies and investors).

Most direct measures and funds allocated, whether generic or thematic in orientation, support the stimulation of greater R&D investment in R&D performing firms. The most important change in the last 3 years has been the reform of the tax allowance. It is considered to be a lean, hardly selective, generous instrument for corporate R&D. In order to stimulate firms that do not perform R&D, a large number of technology centres, incubators, regional development agencies and business advice providers operate in Austria. Based on the success of the Innovation Voucher Scheme³, an "Innovation Voucher plus" scheme was introduced in July 2011, which has higher funding amounts and requires co-funding⁴ from the applying SME. This should stimulate

¹ Private equity investment funds have to operate as joint stock companies in Austria, while the legal form of a private limited partnership seems to be better suited to "get capital through" (interview with Roland Berger consultants published in the daily newspaper "Die Presse" on 18.4.2011 and accessed at http://diepresse.com/home/wirtschaft/economist/651206/Risikokapital_Geld-ist-da-wird-aber-nicht-investiert on 14 February 2012.

For a more detailed analysis see Kaltenegger, C. and Marchart, J. (2007) and Janger, J. (2009).

² http://www.pfm-magazin.at/Mangel_an_Venture_Capital_in_Oesterreich.id.13043.htm, accessed on 14 February 2012

³ According to the interim evaluation carried out by Good, B. and Tiefenthaler, B. (2011)

⁴ The original Innovation Voucher scheme did not require co-funding from the applying SME (see presentation by R. Weißmayer of FFG on 25 January 2011 in Graz on the Innovation Voucher scheme).

behavioural additionality and bring the SMEs closer to the standard mainstream programmes of FFG.

Attracting R&D-performing firms from abroad is essential for Austria, because around one sixth of financial resources for R&D performed by enterprises are funded from abroad. Austria offers a competitive infrastructure which is also used as a regional hub to Central and Eastern Europe. Furthermore, the provision of scientific infrastructure, the specific support measures to attract R&D performing firms from abroad, as well as the science-industry programmes contribute to comparatively large R&D investments of multinational enterprises in Austria.⁵

As regards increasing extramural R&D carried out in cooperation with universities and public research organisations, it is safe to say that links between science and industry, which were perceived as the main shortcomings of the Austrian research and innovation system in the 1990s, have been established at a sufficient level, supported by a broad and costly intervention portfolio.

R&D is well established in terms of institutional funding for universities. Competitive R&D funding, especially for basic research, however, remains comparatively low in Austria.

In general, Austria's RTDI policy and its national policy mix are aligned with ERA pillars and objectives to a large extent. Austria is a small but open economy, also in terms of its labour market. There are hardly any either codified or informal restrictions for researchers from abroad (especially from the EU) to move to Austria for work.

Cross-border cooperation and European knowledge transfer are well established, both at the level of researchers, research organisations from industry and academia, and research funding agencies. Knowledge sharing and open access as key ERA dimensions are also well established in Austria.

The absence of an aligned scientific infrastructure strategy makes a coordinated local, national, regional, European and international approach, which has been repeatedly called for by the Austrian Council (2011), more difficult. The availability of, and access to, research infrastructures constitutes a bottleneck for the further development of research in Austria.

In terms of research organisations, much progress towards autonomy (also in financial terms) has already been made in the university sector in the last decade. However, there is a need to reform the university financing model and to make research financing in general more competitive and project-based. The cooperation and division of labour (and objectives) between universities and the non-university sector (incl. universities of applied sciences) still leaves room for improvement.

The Austrian R&D funding portfolio is still focussed on technological research and technology transfer, while only recently more emphasis has been directed towards non-technological innovations in manufacturing and in the service sector. Public sector innovation and social innovations are not tackled by the existing funding portfolio. Innovation procurement is at a pilot stage.

⁵ While in 2009 on average 8.4% of GERD were financed from abroad in the EU-27, the respective share in Austria was 16.8% (Eurostat, accessed on 14 February 2012).

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1 Introduction

Austria is one of the smaller EU Member States, accounting for less than 1.7% of the population of the EU-27. The country belongs to the richest EU Member States, with a GDP per capita of €34,120 and a total GDP of € 286.18bn in 2010. The economic development of Austria in the last three years has constantly been above the EU average. Real GDP growth in 2011 is expected to be around 3.3%⁶ (EU-27: 1.5%⁷). In 2010 it was 2.3% (EU-27: 2%) and -3.8% in 2009 (EU-27: -4.4). Austria was less strongly affected by the financial crisis and has been able to recover faster than most other EU countries. On the R&D input side, Austria belongs to the EU countries with the highest GERD/GDP rate, which was 2.76% in 2010 (EU-27: 2.0%). It is expected that the GERD/GDP ratio will almost stagnate or only slightly increase to 2.79% in 2011. In 2011, only 44.6% of all research expenditure will be financed by the domestic business enterprise sector (BES), which amounts to roughly €3.7b and is considerably below the EU-27 average. The R&D finance capacity of the BES, however, will increase by 5.9% in 2011 (BMWF, BMVIT and BMWFJ 2011 and Statistik Austria⁸) after a decline in 2009 and only small growth in 2010. In 2011 the financial R&D contribution of the public sector is 38.7% (around € 3.21b), which is an increase of 4.5% compared to 2010. The state is the main public funder of R&D (€2.73b). The financial contributions of the Austrian “Bundesländer” (federal states, €394m) and of other public institutions (e.g. communities, chambers, etc., €87m) are comparatively low. €1.34b of R&D expenditure is financed from abroad. GERD financed from abroad as % of GDP was 0.45% in 2010, which is the highest relative share within the EU. Finances from abroad are mainly allocations from international enterprises to domestic subsidiaries which perform R&D in Austria. A smaller part is *juste retour* from the EU’s Framework Programme for RTD. By sectors of R&D performance, BERD (business expenditure on R&D) was 1.94% in Austria in 2009, which is well above the EU-27 average (1.25%). HERD as % of GDP was 0.66% in 2009 (EU-27: 0.48%), while GOVERD as % of GDP (expenditure by public research organisations which do not belong to the Higher Education Sector [HES]) in Austria is traditionally below the EU-27 average (0.15% vs. 0.27% in 2009). In 2009, the economic sectors with the highest R&D expenditure in Austria were “*electronic equipment*”, followed by “*machine building*”, “*architecture; engineering; technical, physical and chemical investigations*”, “*automotives*”, “*other R&D*”, “*R&D in biotechnology*”, “*electronic components and semi-conductors*”, and “*data processing*” (Statistics Austria).

⁶ Austrian Federal Reserve,

http://www.oenb.at/de/geldp_volksw/prognosen/makroprognose/gesamtwirtschaftliche_prognose.jsp, accessed on 2 February 2012 resp. 3.0% according to

<http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsieb020>, accessed on 19 June 2012:

⁷ <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsieb020>, accessed on 19 June 2012:

⁸

http://www.statistik.at/web_de/statistiken/forschung_und_innovation/globalschaetzung_forschungsquote_jaehrlich/index.html, accessed on 14 February 2012

Human resources in science and technology (S&T) defined as population either with a tertiary education *or* employed in a scientific or technical occupation⁹ as a share of labour force were 39.2% in Austria in 2010¹⁰, which roughly corresponds to the EU-27 average. This relatively low share - when compared to the good economic performance of Austria - is mainly caused by the low tertiary education rate among the age cohort of 30-34, which was only 23.5% in Austria compared to 33.6% in the EU-27 (2010). The tertiary education rate of the age cohort of 30-34 is increasing faster at EU level than in Austria. The main reasons for this lag are the comparatively low tertiary enrolment rate and the comparatively high share of students who do not complete their tertiary education.

The FTE (full-time equivalent) stock of R&D personnel in Austria in 2009 was 56,437.5, which is an increase of 6.0% compared to 2007. In 2009 67.9% of R&D personnel were employed in the BES, 26.7% in the HES, 4.7% in the government sector, and 0.7% in the private non-profit sector.

As regards output data, 56.2% of all Austrian companies performed innovation activities between 2006 and 2008. 31.2% were engaged in product innovations, 32.0% in process innovations, 34.9% in organisational innovations and 27.3% in marketing innovations (Statistik Austria). The production sector is more innovative in general than the service sector, and larger companies are more inclined towards innovation than small enterprises, generally speaking. The most innovative industries are *"IT, electronic and optical devices, and electronic equipment"*, followed by *"publishing houses, telecommunication, IT services"*, *"machine building industries"*, *"chemical and pharmaceutical industries"*, and *"automotive industries"*. On average 11.2% of the turnover of Austrian companies with product innovations is caused by successful product innovations. In terms of sectors, the *"IT, electronic and optical devices, and electronic equipment"* industry is the most outstanding (33.2% of the turnover is caused by product innovations), followed by *"machine building industries"* (25.4%), *"publishing houses, telecommunication, IT services"* (23.3%), *"automotive industries"* (21.8%), and *"production of metals"* (20.2%).

In terms of publication output, no significant changes throughout the last three years can be ascertained. Austria's share in scientific publications worldwide is slightly above 0.6%, and as to speed and subject matter, it depends on global mega-trends, like in all other small countries (Schibany and Gassler, 2010). Although Austria had an above average growth rate expressed in its share of scientific publications worldwide, which rose from 0.61% in 1995 to 0.64% in 2007, Austrian researchers – in total - are performing just average or below average compared with the European average. In terms of citations, Austria outperforms Greece and Spain, but is still below the European average (44.18 for Austria vs. 73.62 for the EU-15 average). Regarding the number of often-cited researchers, which is an indication of the excellence of the research system, Austria ranges among the first 20 countries worldwide with its 12 often cited researchers, but at considerable distance to the top-countries (BMWF, BMVIT, BMWFJ, 2009). This inconclusive pattern is probably mainly caused by the relatively low budget appropriations for basic research in Austria (0.41% of GDP in 2009, or only 19% of all R&D expenditure). On a global level, one can conclude that Austria's scientific research

⁹ According to the definition of the Canberra Manual (OECD, Paris, 1995)

¹⁰

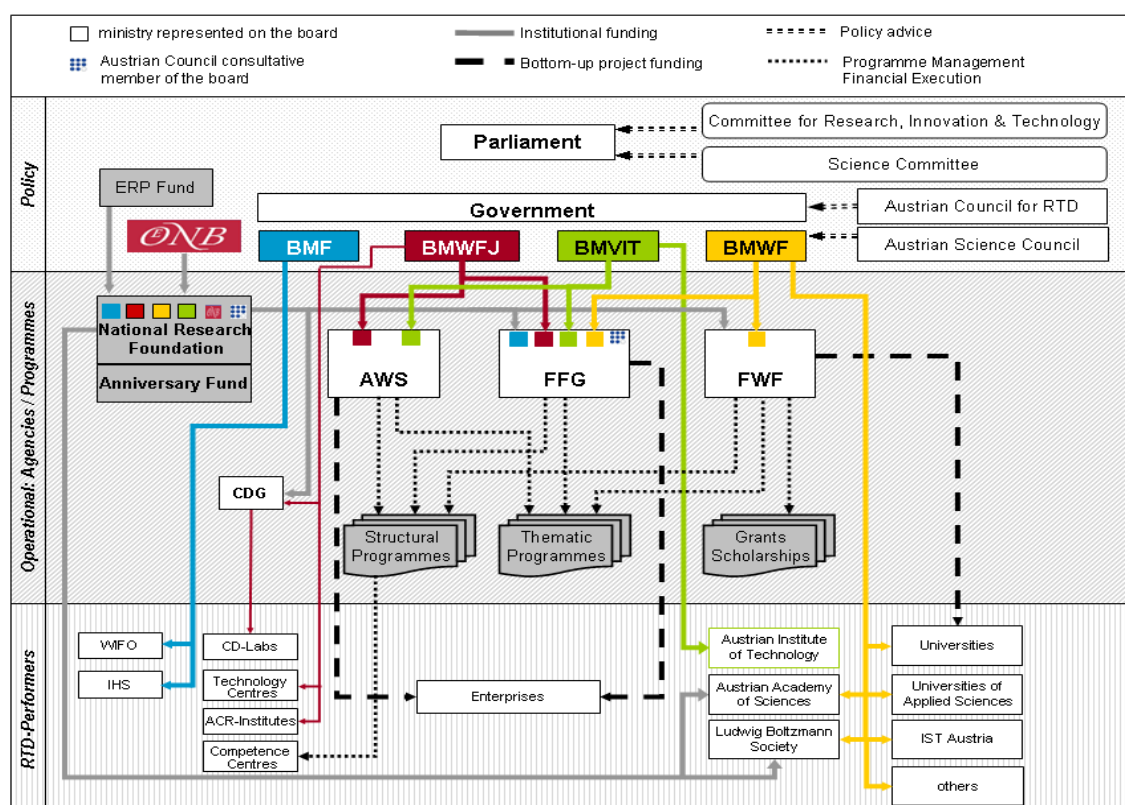
<http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=de&pcode=tsc00025&plugin=1>, accessed on 14 February 2012

has comparative specialisation advantages in the natural sciences and formal sciences (BMWF, BMVIT, BMWFJ, 2009).

The throughput statistics are comparatively better, positioning the Austrian output in terms of EPO patents per million of population, the community trademarks per million of population and the community designs per million of population significantly above the EU-27 average (IUS 2010). This is a clear indication for the performance orientation of applied R&D in Austria.

The institutional RTDI governance set-up, which was fundamentally reshaped in the first decade of this century, has not changed over the last 3 years (see Fig. 1). Despite the fact that the structure of the RTDI system has remained stable, the fluctuation of the science ministers in charge has accelerated. The main development of the last two years in respect of RTDI governance was the publication of the Austrian RTDI Strategy. This strategy builds on the results of the Austrian "Research Dialogue" (2008), the "System Evaluation" of the R&D support and funding system (2009), and the strategic recommendations of the Austrian Council for RTD (2010). It introduced a long awaited coordinated vision and strategy to which all relevant Austrian Federal ministries contributed. In order to avoid duplications and to better align interventions between the ministries in charge of RTDI, as well as to move forward the implementation of the strategy, a task force of senior officials was installed in summer 2011. No other changes to the RTDI governance system have been introduced by the strategy yet.¹¹

Figure 1: Structure of the Austrian Research System



Legend: ÖNB (Austrian Federal Reserve), BMF (Ministry of Finance), BMWFJ (Ministry of Economy, Family and Youth), BMVIT (Ministry of Transport, Innovation and Technology), BMWF (Ministry of Science and Research); AWS (Austria Business Service), FFG (Austrian Research Promotion Agency), FWF (Austrian Science Fund), CDG (Christian Doppler Research Society), WIFO (Austrian

¹¹ cut-off date: November 2011.

Institute of Economic Research), IHS (Institute for Advanced Studies), ACR-Institutes (Austrian Cooperative Research Institutes), IST Austria (Institute of Science and Technology Austria)

2 Structural challenges faced by the national system

In 2010, the Austrian Institute of Economic Research listed among the supply-side structural bottlenecks for growth (Ederer and Janger, 2010):

1. *a weak human capital basis for innovation*, expressed by a low tertiary education rate; a low number of science and engineering graduates (especially women) and a strong concentration on traditional crafts (especially by women);
2. *deficits in R&D* concerning a low number of research conducting enterprises and a strong concentration of R&D expenditure on relatively few companies; low start-up and growth dynamics of innovative enterprises; improvable quality of university research and low volume of university-based basic research;
3. *competition bottlenecks* expressed by a low competition intensity in certain service sectors (liberal professions, energy sector, banking and insurance sector, crafts, estate agents and property management, pharmacies, railways); sporadic limited competition in the productive sector (e.g. through cartel formation); low start-up dynamics of innovative companies to advance competition intensity in established industries;
4. *deficits in labour participation* concerning the labour quota of the elderly and of migrants, and low qualification of persons with a migration background.

On the demand side, the following structural bottlenecks exist:

5. *private demand weaknesses* concerning domestic private demand (both in terms of investments and private consumption) and low export orientation towards emerging countries.

By and large these structural challenges are common knowledge. Thus it was not surprising that many of them were openly addressed by the Austrian Federal Government's Strategy for Research, Technology and Innovation for the next decade, launched on 8 March 2011. According to its motto "*realising potentials, increasing dynamics, creating the future: becoming an Innovation Leader*", this strategy addresses measures to strengthen national research structures with a focus on excellence, to foster the innovative capacity of companies, enable thematic priority setting, raise the efficiency of governance, and to link research, technology and innovation to the education system. The strategy should also help to mobilise research, technology and innovation for tackling the grand challenges of society and the economy.

Hence, with its 2020 perspective, the strategy is considered to be a guideline for approaching the Europe 2020 national R&D target, and for contributing to the implementation of the Innovation Union.

The Federal Government's RTDI Strategy has been the result of a multi-layer process, starting with a nationwide stakeholder consultation (Austrian Research Dialogue), followed by a thorough evaluation of the research funding system ("System Evaluation"), the "Strategy 2020" developed by the Austrian Council, and a final drafting process involving government experts from six ministries.

In the government's RTDI strategy quite a substantial number of structural challenges are featured which the national innovation system is confronted with. Among them are

several which – from a systemic RTDI perspective – constitute major bottlenecks for a prosperous future RTDI development, such as

- a **strained university system** with unfavourable student-to-teacher ratios, limited scientific career options (no sufficient tenure track), and especially a persistently **low number of S&E graduates**, a fact which is aggravated by a declining age cohort of pupils between 15 and 19 years of age, and a definitive gender imbalance in S&E studies;
- a relatively **narrow financial base for fundamental research**, accompanied by **deficiencies in medium and large-scale research infrastructures and in competitive research funding**, and characterised by little differentiation of research profiles at and between universities and insufficient cooperation between universities and non-university research organisations, as well as between universities and universities of applied sciences;
- a **stagnating share of R&D financing from the business-enterprise sector** (with increasing R&D expenditure in absolute terms), faced with a slightly but steadily **declining share of corporate R&D funding from abroad** (although still from a high level), partially balanced by transfer of a relatively high amount of public funds into the corporate R&D sector (compared to the EU average), well based on a developed science-industry cooperation portfolio, but with **little impact on structural economic change in terms of added-value and high-tech orientation**;
- **low dynamics in increasing the intensity of private equity and venture capital** in the formation of technology-based, innovative firms (although improvements are expected soon), aggravated by a deficient regulatory (VC) framework, administrative hurdles in the areas of **enterprise formation** and service regulations, and characterised by a hardly developed **entrepreneurship culture** (which gets little support from innovation-related education and training curricula), a weak **competition policy** with yet few concrete actions and outputs concerning demand-side policies and measures, innovation procurement, service and public sector innovation (beyond eGovernance, which is fairly well developed in Austria) as well as social innovation.

In addition, there are a few challenges which are not highlighted in the strategy:

- first of all there is **no roadmap with budgetary indications and responsibilities**, which would be required to implement the activities proposed in the strategy;
- research in the **social sciences** is taken into account to an insufficient extent, including a precarious private non-profit social-sciences R&D sector whose tenuous situation was partially caused by a complete elimination of basic funding by the present government in 2011;
- consideration of the **grand/societal challenges** in RTDI funding is still expandable – although eventually beginning;
- a **sub-critical R&D internationalisation portfolio** (despite a good integration in coordinated European activities; e.g. international ERA-NETs);
- **little emphasis on impact evaluations** of RTDI interventions despite a well-developed RTDI evaluation culture;
- **evaluation of research institutions** is missing or is only relatively “light”.

3 Assessment of the national innovation strategy

3.1 National research and innovation priorities

The Austrian RTDI Strategy, which is comprehensive and multi-annual but is without a dedicated budgetary roadmap, clearly signposts the following national research and innovation priorities:

- a sustainable **reform of the Austrian education system** and better coordination between the education and innovation spheres;
- **enhancing basic and applied research** and their respective institutions;
- **improving the innovation capacities of companies** (increasing technological capabilities, intensification of R&D and technology transfer, increased use of demand-side measures such as innovation procurement);
- and **increasing the efficiency of political governance** (clear structures, high leverage effects of interventions, impact-oriented usage of resources).

With this RTDI Strategy, the criticism that has repeatedly been voiced for many years concerning the lack of clearly established procedures for priority setting within the complex Austrian RTDI governance system has come to a halt. The present strategy builds on some of the country's well-functioning and highly developed mechanisms for policy analysis, evaluation and monitoring, among which the publication of the results of the System Evaluation of Austria's R&D support and funding system in 2009 fed substantially into subsequent policy debates and decision making. This System Evaluation concluded that in order to advance from an "innovation follower" to an "innovation leader", the country must:

- move from a narrowly defined innovation policy towards a broader approach, including linkages with educational policies and other social and economic framework conditions,
- design coordinated and consistent public interventions based on a shared vision and a joint strategy,
- and move from imitation to a more radical innovation strategy.

A series of public debates and consultations preceded the publication of the Austrian RTDI strategy. Following the comprehensive Research Dialogue¹², which took place in 2008 and which was more of a public relations and public stimulation event than an output-oriented consultation, a number of larger stakeholder consultations with public mandate were implemented:

- (i) a public consultation on the "Strategy 2020 – Research, Technology and Innovation for Austria"¹³ by the Austrian Council;
- (ii) a public consultation on the future of the European Framework Programme¹⁴ (January to March 2010 and again about Horizon 2020 in December 2011¹⁵) and

¹² http://www.bmwf.gv.at/startseite/forschung/oesterr_forschungsdialog/

¹³ <http://www.forschungsstrategie.at/>

¹⁴ <http://www.era.gv.at/space/11442/directory/15239.html>

¹⁵ <http://consultation2011.era.gv.at/>

- (iii) a public consultation regarding the Austrian Energy Research Strategy in February 2010¹⁶.

Since its inception, however, the implementation of the Austrian government's Strategy for Research, Technology and Innovation has been impeded by the fact that all ministries are and will be confronted with public budget consolidation requirements for the years to come.

Within three months from publication of the strategy, the High-level Research, Technology and Innovation Task Force was established on 22 June 2011. It is headed by the Austrian Federal Chancellery and co-headed by the Austrian Federal Ministry of Finance. Further high-level representatives are delegated by the Federal Ministry of Science and Research (BMWF), the Federal Ministry for Education, Arts and Culture (BMUKK), the Federal Ministry of Transport, Innovation and Technology (BMVIT), and the Federal Ministry of Economy, Family and Youth (BMWFJ). At the first meeting it was decided also to invite the chairman of the Austrian Council into the Task Force.

The Task Force started with the preparation of the roadmap by **putting educational reform and the human resources issue high on the priority agenda**, which also range among the "hot" issues in Austria. Three dominant aspects in the public debate have to be mentioned in this respect:

- 1) the political and public discussions around the "Higher Education Plan" ("Hochschulplan"), whose core elements were presented by the Minister of Science and Research on 21 December 2011, and which foresees a radical reform of the financing systems of universities in the years to come (including access and capacity limitations respectively for certain fields of study, a re-introduction of tuition fees, and compensation payment for non-Austrian students¹⁷);
- 2) the softening-up of the strict differentiation of pupils enrolled at the age of 10 in either "Hauptschulen" (grammar schools which usually lead to the pupils leaving the secondary school system at the age of 15) or "Gymnasien" or "Mittelschulen" respectively (junior high schools which usually lead to the "Matura"¹⁸ and the authorisation to enrol in higher education), by introducing the concept of a "neue Mittelschule" (new secondary school), which should enable an easier transition to upper secondary high schools with "Matura" and which should prevent pupils from having their career paths determined too early;
- 3) better assistance for persons with migration background in order to reduce prevailing deficits in the German language, and better use of the "human capital" of migrants.

While it is definitely too early to assess the "Hochschulplan", which still lacks political consensus in the government, the plans for the implementation of the "neue Mittelschule", due to replace the "Hauptschule" by 2019¹⁹, are dismissed by some critics

¹⁶ <http://www.energieforschungsstrategie.at>

¹⁷ This aspect is triggered by the large influx of German students to the Austrian HES due to the *numerus-clausus* system in Germany on the one hand and unrestricted (and gratis) university access in Austria on the other. The international Advisory Board for the Higher Education Plan estimates a compensation payment potential of €280m (see: "Zur Entwicklung und Dynamisierung der österreichischen Hochschullandschaft – eine Außensicht. Rahmenkonzept für einen Hochschulplan". Report presented by Loprieno, A., Menzel, E. and Schenker-Wicki, A. in August 2011; p. 53).

¹⁸ i.e. the general qualification for university entrance.

¹⁹ This decision was taken by the Council of Ministers on 20 December 2011.

as a marketing measure rather than a substantial school reform²⁰. However, the “neue Mittelschule” has been the first system-wide introduction of a new type of school for 50 years. This type of school provides a differentiation between basic general education and advanced general education in the subjects of German, mathematics and a first foreign language in the last 2 years. The assessment of advanced general education should correspond to the “Gymnasium” qualification level and should thus make the transition into higher secondary schools easier. Team teaching and an additional six hours of school education are foreseen to attain this qualification level.

Regarding better assistance for migrants in terms of acquisition of German language skills, the policy debate in the second half of 2011 centred on the sources of financing language training for children prior to starting school. A solution was found in October 2011. Progress could also be made in facilitating the usage of the human capital of third country foreigners who graduate in Austria. They are now entitled to enter the Austrian labour market immediately after their final degree without undergoing the heavier procedure provided for third-country foreigners who live abroad and who are looking for job opportunities in Austria.

Another “hot” topic is Austria’s RTDI priority to **enhance basic and applied research and their respective institutions**. In this context, three recent developments have to be highlighted:

- 1) the **kick-off of the next reform step within the higher education sector (HES)** (after a series of previous major milestones, i.e. the introduction of university autonomy by the Higher Education Act in 2002; introduction of a performance agreement system in the middle of the last decade, and the successful conclusion of a collective agreement between the universities and the unions concerning the rights of university personnel, including the introduction of – a still rather embryonic - tenure track system), which is based on the **framework for a “Higher Education Plan”²¹ (“Hochschulplan”)**. This plan foresees **a new system of study place financing** (“Studienplatzfinanzierung”) with coherent capacity plans; more differentiated **profile shaping** among universities and within the HES which should be accompanied by an extension of study places at universities of applied sciences to “disburden” the universities²²; a new **governance system** which incorporates the Austrian Federal States (“Bundesländer”) but also requires additional co-financing from them²³; **higher funding for (competition-based) basic research** at universities, and granting of a fixed research budget for universities of applied sciences in the medium run, etc. These reform steps are regarded as milestones which could lead to a more efficient and coherent higher education system in the future. The Higher Education Plan, however, still lacks political consensus in the government, and its implementation is just about to start in a step-by-step process.

²⁰ e.g. by the Green Party and the Alliance for the Future of Austria (BZÖ-Bündnis Zukunft Österreich): <http://diepresse.com/home/bildung/schule/pflichtschulen/718228/Neue-Mittelschule-kommt-Kritik-von-Opinion>

²¹ “Zur Entwicklung und Dynamisierung der österreichischen Hochschullandschaft – eine Außensicht. Rahmenkonzept für einen Hochschulplan“. Report presented by Loprieno, A., Menzel, E. and Schenker-Wicki, A. in August 2011.

²² The recommendation of the Advisory Board for the Higher Education Plan is a ratio of 40:60 (students enrolled at universities of applied sciences vs. students enrolled at universities).

²³ Eventually co-financed by Structural Funds, the usage of which for the HES in Austria is hardly coordinated

- 2) While the framework concept for the Higher Education Plan also recommends the introduction of performance agreements for universities of applied sciences ("Fachhochschulen") in the future, a **performance agreement for the Austrian Academy of Sciences, (ÖAW)**, Austria's largest non-university R&D organisation, was concluded on 4 November 2011 for the very first time. This process was not entirely harmonious. For the performance agreement period 2012-2014, a global budget of €224m has been agreed (plus additional dedicated funds for fellowships and international programmes as well as membership fees), which - if no countermeasures are taken - would **result in a deficit of around €38m to €40m**, due to liabilities of previous years and increasing personnel costs. Therefore, the works council of the ÖAW fears a shutdown of some institutes and a lay-off of up to 300 persons. The ÖAW's management's response is **to concentrate the Academy's research activities on six major thematic priority research areas**.²⁴

As a consequence, the present 63 research units of the ÖAW should be concentrated in 22 institutes. The management is supposed to bring forward a specific reform and restructuring programme by March 2012. Negotiations with universities to include some ÖAW institutes into the university fabric have been announced, which could save around 100 of the up to 300 insecure jobs. On the positive side, the ÖAW highlights - among other issues - an extended planning reliability, especially for promising research priorities, the introduction of internationally competitive career models, an optimisation and professionalisation of the Academy's governance structures, and increased cooperation with universities. The ÖAW will receive another €10m to implement the necessary restructuring and reform measures.

- 3) Already in autumn 2010, the government decided to **eliminate the basic funding for private non-profit research organisations**. Although triggered by the need to consolidate the public budget, this adjustment had little effect in budgetary terms (because of the low absolute budget savings), but dramatic consequences for this sector which is small compared to the overall Austrian RTDI system, but plays a vigorous role in the research "ecology" in a few areas (e.g. the social sciences). As a consequence the **"Wissenschaftskonferenz Österreich"** ("Science Conference Austria"), a bottom-up association of several non-university research organisations, was set up in winter 2010/2011. It launched a petition against the massive budgetary cutbacks for this sector which was signed by around 20,000 supporters. The Science Conference Austria requests a stronger consideration of this sector in the Austrian S&T system, an introduction of public structural funding based on institutional evaluations, as well as performance agreements and national co-funding of projects financed under the European Framework Programme for RTD. The latter claim was taken-up by the BMWF in 2011 by implementing the TOP.EU programme to co-fund

²⁴ European identities and protection and interpretation of cultural heritage;
Demographic change, migration and integration of people in heterogeneous innovative societies;
Bio-medical fundamental research;
Molecular plant biology;
Applied mathematics including modelling and bio-informatics;
Quantum optics and quantum information

FP7 participation of non-university, private research organisations operating in the field of social sciences and humanities.

3.2 Trends in R&D funding

The major Austrian R&D investment target stipulated by the Austrian RTDI strategy is the attainment of a GERD/GDP ratio of 3.76% in the year 2020. Given the stagnation of the research quota development at a level of around 2.75% between 2009 and 2011 (after a dynamic development from 2000 to 2008), this target is very ambitious, especially because of the second major target which anticipates that 2/3 (but preferably 70%) should be paid by the business enterprise sector (BES), which would result in a BERD/GDP rate of around 2.5%.

The overall gross expenditure for R&D would have to increase from currently €8.29b to €15.79b in 2020, which would require a yearly growth of 7.43% (BMWF, BMVIT and BMWFJ 2011). Just for comparison: The already very dynamic development of the GERD/GDP quota in Austria in the first decade of the 21st century was an annual average of 6.78% and was by far among the highest in Europe.²⁵ The highest growth rate, however, would have to be implemented in the field of basic research, for which the Austrian RTDI strategy stipulated investments corresponding to the level of leading research nations. To reach an expenditure volume in basic research of approximately €3.9b in 2020, a yearly growth rate of 11.77% would be necessary (BMWF, BMVIT and BMWFJ 2011). While the Austrian Science Fund, which is predominantly responsible for funding basic research, invested €17.5 per inhabitant in 2009, the Swiss SNF invested €54.1 per inhabitant in 2009, AKA from Finland €58.2, NWO in the Netherlands €33.3, and DFG in Germany €26.8 (BMWF, BMVIT, BMWFJ 2011).

Table 1: Basic indicators for R&D investments in Austria²⁶

	2008	2009	2010	EU average 2010
GDP growth rate	1.4	-3.8	2.3	2.0
GERD as % of GDP	2.67	2.72	2.76	2.0
GERD per capita (in €)	908.4	903.2	931.9	490.2
GBAORD (€ million)	1,986,775	2,149,916	2,412,731	92,729,05
GBAORD as % of GDP	0.70	0.78	0.86	0.76
BERD (€ million)	5,232,63	5,092,902	5,372,705	151,125,56
BERD as % of GDP	1.85	1.85	1.88	1.23
GERD financed by abroad as % of GDP	0.44	0.46	0.45	0.17 ²⁷
GERD financed by abroad as % of total GERD²⁸	16.4	16.8 ²⁹	16.4	N/A ³⁰

²⁵ Even with a hypothetical adjustment trajectory back to a public finance share of 33% (which is at present 39%), a yearly average increase of € 200 million would be necessary until the middle of this decade, which is difficult to imagine given the tough budget consolidation rhetoric of Austrian policy-makers. By retaining the current financial share of the BES at 60.8%, the additional financial effort of the BES would result in an average yearly increase of € 418 million in the next few years.

²⁶ Eurostat, accessed on 7.11.2011, unless otherwise indicated.

²⁷ 2009

²⁸ Eurostat, accessed on 28.1.2012

	2008	2009	2010	EU average 2010
R&D performed by HEIs (% of GERD)³¹	25.1	26.1	26.1	24.2
R&D performed by PROs (% of GERD)³²	5.2	5.5	5.4	13.2
R&D performed by Business Enterprise sector (as % of GERD)³³	69.3	68.0	68.1	61.5

Regarding the main R&D funding streams, the following observations can be summarised:

- 1) Public funding is pre-dominantly disbursed on the basis of institutional funding, which – as regards universities – has been based on performance agreements for six years. In November 2011 the first performance based institutional funding regime was concluded between the BMWF and Austria's largest non-university public research organisation, the Austrian Academy of Sciences. Despite the fact that all major RTDI policy papers³⁴ request increasing competitive budgets (especially for basic research), the competitive budgets of the Austrian Science Fund (FWF) and of the Austrian Research Promotion Agency (FFG), which supports applied and industrially-oriented R&D in particular, have not increased remarkably during the last three years. In 2010, the funding volume of FFG for its portfolio of 40 programmes and more than 100 sub-programmes amounted to €554m, representing a cash value of €431m. The funding volume of FWF for around 20 programmes in 2010 was €171.8m.
- 2) The majority of FWF funding refers to projects formulated bottom-up and submitted by individual applicants. The funding share of these projects is almost 50%. 3,405 individual researchers (mainly doctoral students and post-docs) were funded through FWF projects in 2010. The situation regarding FFG funding is slightly different: Although there also around 50% is bottom-up funding for individual companies, a considerable part (22% or €123.4m) flows into collaborative science-industry projects which have to be co-financed by the participating organisations. Most of the funds in this context are allocated to the COMET-programme with €85m. In general, the priority focus on science-industry projects throughout the last 10 years has resulted in an increased diversity of participants within the FFG programmes. Although the relative share of enterprises decreased from 79% in 2004 to 55% in 2010, FFG was able to offer funding for more than 1,600 SMEs with a volume of €131m in 2010 (BMWF, BMVIT, BMWFJ

²⁹ According to national statistics this value should be 16.2% (www.statistik.at, accessed on 28.1.2012).

³⁰ 8.4% (2009); 9.04 (2005)

³¹

<http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsiir030&language=de>, accessed on 28.1.2012

³²

<http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsiir030&language=de>, accessed on 28.1.2012

³³

<http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsiir030&language=de>, accessed on 28.1.2012

³⁴ Incl. the Austrian RTDI Strategy and the framework concept for the Higher Education Plan (Loprieno, A., Menzel, E. and Schenker-Wicki 2011)

2011, p.48). The extension of the Innovation Voucher Programme is an important instrument for addressing SMEs and for stimulating cooperation with research organisations. The evaluation of the Innovation Voucher Programme revealed that 80% of the SMEs who use the Innovation Voucher had not been funded by FFG before and that the large share of new clients did not decrease over the years (Good and Tiefenthaler 2011). Summing up, it can be said that public-private R&D partnerships in Austria are mainly triggered by RTDI funding programmes implemented by FFG and based on single individual projects.

3) As regards tax incentives, the following changes have been introduced in Austria recently “Budgetbegleitgesetz” (Budget Accompanying Act) 2011, Federal Law Gazette. I no. 111/2010):

- All old R&D tax-exemption schemes are being phased out (temporary arrangement according to § 124b sub-paragraph 180 EStG (Income Tax Act), but
- the research premium (for industrial R&D for large, medium-sized and small enterprises) remains the single element of tax-based research funding (§ 124b sub-paragraph 180 EStG (Income Tax Act));
- on 1.1.2011 the research premium was increased from 8% to 10% for costs arising from intramural research and contracted research (specification of the assessment basis by a regulation of the Ministry of Finance, which itself is based on the Frascati Manual);
- perpetuation of the cap of € 100,000 for contracted research.

Summarising, the overall balance between competitive and institutional funding, subsidies vs. tax incentives, and the extent of collaborative funding have not changed in the last three years. Despite budget consolidation requirements, the overall share of public R&D expenditure remains on a high level. Reductions have mostly affected the private non-profit sector and are about to affect the Austrian Academy of Sciences and – probably - the HES in the near future. From the viewpoint of the BMWF, this should bring more efficiency into the system. Negotiations for the next performance agreement period between the universities and the BMWF will take place in 2012. Given the public budget consolidation requirements, the signals sent by the BMWF are hardly encouraging. Regarding R&D funding sources, the share of the public sector has increased during the last three years, which has anti-cyclically compensated for the stagnating R&D expenditures of the BES. However, between 2010 and 2011 the growth of R&D financing of the BES at a rate of 5.89% was already above the nominal economic growth. BES funding increased to €3.7b in 2011 compared to €3.49b in 2010. Among public sources, expenditure at state level remains by far the most important, while the share of the regions remains stable at a low 5% (4.75% in 2011). EU structural funding does not play a big role in Austria. Less than 0.5% of total yearly R&D funding in Austria originates from Structural Funds³⁵. The planned R&D share within the structural funding budget is 20.02%. Combined with innovation activities, however, this share increases to 43.5% of the total ERDF budget (i.e. €524m). There is anecdotic evidence that research organisations

increasingly refrain from applying for ERDF funding due to troublesome and puffed-up bureaucratic financial reporting requirements.

Apart from European programmes, transnational or inter-regional public funding plays a minor role in Austria, while corporate transnational funding is high and of utmost importance for corporate RTDI activities (> 16% of GERD). An exception to the marginal role of transnational public funding is Austria's active role in ERA-NETs. Austrian organisations participate in 39 funded ERA-NETs, most of them in the fields of international cooperation (6), food and agriculture (5), new materials and production technologies (5), and actions of a horizontal nature (5).³⁶ For around 5 years, Austrian policy-makers have been putting more emphasis on grand societal challenges. This has also resulted in a budgetary upgrading of thematic sector programmes, which – at least partly - respond to societal challenges³⁷. In 2010, FFG spent €134,007m in cash on thematic programmes (€138,191m in 2009 and €109,267m in 2008).³⁸

Many of the thematic programmes are based on collaborative R&D, which is the most important public-private partnership model for R&D in Austria. A dedicated funding approach in FFG comprises so-called “structural programmes” whose main objectives are to support science-industry partnerships and applied R&D centred human capital development initiatives. Among the structural programmes are some of Austria's largest PPP instruments, such as the COMET programme (€88.9m spent on institutionalised university-industry cooperation in 2010) or the COIN programme (€22.7m spent on structural cooperation between industry and universities of applied sciences in 2010). These programmes require substantial R&D co-financing from the participating BES partners (usually 50% of their own costs).

3.3 *Evolution and analysis of the policy mixes*

The RTDI policy mix can be defined as the combination of policy instruments which interact to influence the quantity and quality of R&D investment in the public and private sectors. Under this definition, policy instruments include all programmes, organisations, rules and regulations with active involvement of the public sector which intentionally or unintentionally affect R&D investments.

The “Policy Mix Project”³⁹ identified the following six “routes” towards stimulating R&D investment:

- promoting the establishment of new indigenous R&D performing firms;
- stimulating greater R&D investment in R&D performing firms;
- stimulating firms that do not yet perform R&D;
- attracting R&D-performing firms from abroad;
- increasing extramural R&D carried out in cooperation with the public sector or other firms;

³⁶ Proviso Überblicksbericht (Overview Report), June 2011.

³⁷ e.g., “Energie der Zukunft” (Energy for the Future) programme, “IV“Splus“ programme in the field of intelligent transportation, or the “KIRAS” programme dealing with security research in a wider sense.

³⁸ Data taken from the “Österreichische Forschungs- und Technologiebericht” (Austrian Research and Technology Report) 2009, 2010 and 2011, ed by BMWF, BMVIT and BMWFJ.

³⁹ http://www.eurosfair.prdd.fr/7pc/doc/1249471847_policy_mixes_rd_ue_2009.pdf

- increasing R&D in the public sector.

In general, the policy mix in Austria over the last 3 years has not changed significantly. Well-known structural deficits, such as lack of venture capital or low licence and patent revenues from abroad, remain, as evidenced by the IUS 2010. Most of these deficits are at the focus of public interventions, but a certain degree of inertia is caused by underlying structures rooted in the inherited economic structure and culture of the country, with – for instance – an R&D risk-averse banking sector, a hardly developed hi-tech orientation, a broad consensus to preserve the status-quo rather than to reform inefficient lock-in structures, or a rather risk-adverse entrepreneurial attitude (to name just a few examples).

The Austrian policy mix, which includes a broad assortment of measures, covers all routes (see Hofer 2009), but slightly different weights are given to the individual routes.

Route 1: Promoting the establishment of new indigenous R&D performing firms

According to estimates by the Austrian Council, only 5-10% of approximately 30,000 annual start-ups are knowledge-intensive, technology-oriented firms (Austrian Government 2011). The proportion of young, fast growing firms is significantly below average by international comparison. The number of academic spin-offs, however, has increased in recent years and can be estimated at around 500 academic spin-offs yearly⁴⁰ (Schibany and Gassler 2010). In order to enhance the readiness to set up academic spin-offs, the Austrian Council (2011b) encourages the introduction of formal return-options for failed academic spin-offs to their original academic host institution. Due to sub-par market conditions on the stock exchange, in venture capital and private equity segments, Austria's firms, and especially its innovative entrepreneurs, lack crucial sources of financing for R&D investments. In Austria, financing structures have traditionally been oriented towards loans, which tend to prevent financing high-risk innovation activities (Austrian Government 2011).

To improve entrepreneurial behaviour and enhance the foundation of enterprises, the Austrian government began to support the foundation of innovative and technology-oriented firms with different policies already in the last decade (TC 2008). Initial activities to support the formation of R&D performing firms were centred on the creation of technology, innovation and start-up centres that are now residing under the umbrella organisation known as the Austrian Association of Technology Centres (VTÖ). Later on, measures were implemented to support entrepreneurial behaviour (e.g. with the AplusB Impulse Programme) and instruments for financial support during start-up and early growth were introduced. These are now covered by the AWS ("Austria Wirtschaftsservice") (Hofer 2009).

Among the most recent activities is risk capital formation to generate positive economic effects on economic growth and employment, and on reducing existing structural deficits. These public initiatives are primarily focused on mobilising private risk capital to enhance access to financing young, innovative SMEs in the early stages. In the long run existing "financial gaps" towards traditional financial instruments (e.g. loans) shall be removed and the actual "market failure" shall be balanced⁴¹. The recently introduced

⁴⁰ Academic spin-offs are defined as "*exploitation spin-offs*", which are start-ups requiring the use of new research findings or new scientific processes obtained from public research in which at least one of the founders must have been involved, and "*competence spin-offs*", which are start-ups based essentially on the utilisation of special skills acquired by the founders through their work in science or from their studies. Such special skills need to go beyond what is generally known on the subject (BMWF, BMVIT, BMWA 2007).

⁴¹ The most important instruments in this respect are

Venture Capital/Clean-tech Initiative can be seen as a first step related to this, where an institution associated with the public sector (i.e. AWS) assumes the role of investor in a private investment fund, thereby signalling to others to trust in the management and business strategy.

Route 2: Stimulating greater R&D investment in R&D performing firms

For more than one decade, stimulating instruments for R&D performing firms has been a clear strength in the Austrian portfolio of R&D policies. Most direct measures and funds allocated, whether generic or thematic in orientation, support this route (Hofer 2009). The General Programme of the FFG has remained Austria's most important source of public funding for R&D carried out by industry in terms of funding budget, efforts to promote R&D in all economic sectors and industries, areas of technology, and sizes of companies.

The most important change in the last 3 years has been the reform of the tax allowance (as of 1.1.2011) (Budget Accompanying Act 2011, Federal Law Gazette. I no. 111/2010) (see: section 3.2). Although the allowance was increased on 1 January 2011 from 8% to 10%, the Austrian Council calls for a further upgrading of the research premium for smaller enterprises. Furthermore, the Austrian Council (2011b) encourages the introduction of "proof-of-concept" measures and a generally more benevolent evaluation of risky R&D projects submitted to public funding programmes.

Route 3: Stimulating firms that do not perform R&D yet

Companies, especially SMEs not yet performing R&D, are among the most strongly "wooded" target group for R&D and innovation policy in Austria (Hofer 2009). They are addressed by a large number of technology centres, incubators, national and regional funding bodies, regional development agencies, and business advice providers (Tiefenthaler 2009).

The Innovation Voucher Instrument, which was implemented in Austria in 2007, has been evaluated recently (Good and Tiefenthaler 2011). Overall, the Innovation Voucher Programme was well accepted by SMEs. The evaluation ascertained a high degree of satisfaction in terms of networking, new divisions of labour between SMEs and research organisations, knowledge transfer, and innovation stimulation. Contacts established by the SMEs with their research providers remain, however, often in a more informal way and not so much expressed in new project applications. A clear risk for the research organisations is the refusal of payment of the Innovation Voucher by FFG after

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- the "aws-Mittelstandsfonds", which focuses on financing significant projects in the growth stage and targets medium-sized businesses in Austria with max. 500 employees and with a positive and stable development of turnover and/or profit ratio;
 - Venture Capital/Clean-tech Initiative, which is a very recent fund-in-fund initiative focussing on the mobilisation of private risk capital through participation in privately organised venture capital funds based on common sectoral standards, with the ultimate goal to provide risk capital to enhance access to finance for Austrian SMEs in the early stages. Its min. volume at first closing was €30m (incl. AWS share). The Venture Capital Initiative targets R&D businesses with a focus on start-ups, while the Clean-tech Initiative targets development and commercialisation of innovative products/services/processes, focusing on renewable energy, energy efficiency and other green technologies.
 - Promotion of the Development and Establishment of Innovative Companies (JITU) consisting of three modules: PreSeed; Seed Financing; and Temporary Management.
 - Consultancy services focusing on support of IPR protection and exploitation; i2-market for business angels, and enterprise-formation services.

completion of the project⁴² which is hardly ever understandable for the research organisations. Moreover, during the ex-post assessment, technological innovations seem to be preferred to non-technological innovations.

Based on the success of the Innovation Voucher Scheme, an “Innovation Voucher plus” scheme was introduced in July 2011, which has higher funding amounts and requires co-funding from the applying SME, a requirement which is new to the programme.

Route 4: Attracting R&D-performing firms from abroad

The fourth route is essential for Austria, because about one sixth of financial resources for R&D performed by enterprises are funded from abroad. Primarily, this occurs when Austrian R&D is affiliated with a multinational company. This seems to indicate that Austria has become an attractive research location (Hofer 2009).

Public interventions to attract R&D performing firms can be direct (e.g. targeted programmes) or indirect (e.g. by providing an adequate material and immaterial infrastructure). Regarding the latter, Austria in general offers a competitive infrastructure in the centre of the EU with a tradition to act as a regional hub to Central and Eastern Europe. Therefore some multinational enterprises coordinate their Central European business from Austria, especially from Vienna and its vicinity. With increasing locational advantages in the newer EU Member States, however, this traditional lead is being challenged and is shrinking. A recent study confirmed that – for the time being – the availability of qualified personnel and the skill level are still considered as main locational assets by multinational enterprises in Austria (Sieber 2010).

To attract R&D performing firms from abroad more directly, the so-called “Headquarter Strategy – R&D”, a prominent element in the General Programme of FFG, is of particular importance in this context, not least because of the fact that it belongs to the Austrian RTDI programmes with the highest amount of funding (€27,193m in 2010).⁴³ It stimulates the establishment and development of multinational enterprises’ R&D laboratories in Austria. Furthermore, building up infrastructure (e.g. Campus Vienna Biocenter or Software Park Hagenberg) and public-private partnerships (e.g. the Institute of Molecular Biotechnology, a partnership between the Austrian Academy of Sciences and Boehringer Ingelheim), as well as cooperation programmes like CIR-CE and COIN, contribute to this objective. The reformed tax allowances can also be considered supportive in this respect.

Measures to foster excellence are also important (e.g. the Institute of Science and Technology Austria - ISTA), the support of science-industry linkages (e.g. with the CDG laboratories), reforms in the university sector and measures to promote the accumulation of human capital are major determinants on this route (Hofer 2009). The establishment of Josef Ressel Centres is a very recent element in the funding portfolio⁴⁴.

Route 5: Increasing extramural R&D carried out in cooperation with the public sector

⁴² The ex-post evaluation of projects by FFG has been explicitly criticised by the evaluators, who instead call for ex-ante assessments.

⁴³ Since this support measure is also financed by the “Nationalstiftung” (National Foundation), it is expected that it will be confronted with decreasing financial allocations in 2012 due to the low returns of the Foundation (see article in the daily newspaper *Standard* of 1.2.2012).

⁴⁴ The Josef Ressel Centres connect research-oriented universities of applied sciences with companies which gain direct access to the R&D infrastructure and resources of the universities of applied sciences. After the completion of a successful pilot phase (as of 2009), the programme will be rolled out at the beginning of 2012. The Josef Ressel Centres are comparable to the CDG Laboratories, but are limited in funding volume. A decision about new Josef Ressel Centres is expected in June 2012.

This route is very much advanced in Austria and is sometimes even perceived as being “overcrowded” (Hofer 2009). It is safe to say that links between science and industry, which were perceived as the main shortcomings of the Austrian research and innovation system in the 1990s, have been established at a sufficient level, supported by a broad and costly intervention portfolio. Maybe due to the above-mentioned “saturation” of this policy mix route, few new initiatives have been introduced in the last three years.

Among the latest support measures in this respect are the thematic programme “Leuchttürme eMobilität” (Lighthouses of E-mobility), the Josef Ressel Centres, and the Laura Bassi Centres of Expertise. The focus of the latter is to support women at the interface between academic and industrial research.

Although initially announced as a follow-up of the terminated uni:invent programme⁴⁵, which established technology transfer offices at most Austrian universities (Elias 2008), the inclusion of technology transfer activities as a compulsory element in the performance agreements of universities, as requested by the Austrian Council (2011b), has not yet been realised. It remains to be seen if technology transfer activities will be introduced in the new performance agreements which will be concluded in 2012 with a contract period from 2013 to 2015.

Route 6: Increasing R&D in the public sector

There have been no serious changes on this policy mix route in the last three years. Overall, route 6 receives considerable attention in the Austrian research system, yet the focus remains primarily on institutional funding. By far the largest share of institutional funding in the public sector goes to universities. While performance agreements for universities were already introduced in the middle of the last decade, the first full-fledged performance agreement with the Austrian Academy of Sciences, Austria’s largest non-university research organisation, was concluded in Autumn 2011.

Despite a broadly recognised understanding that competitive R&D funding for universities and public research organisations is low compared to other similar countries (Schibany and Gassler, 2010; Leitner et al. 2007), the budget of Austria’s largest basic research fund FWF has not increased remarkably over the last 3 years (€164m in 2008 to €177m in 2010). Funding for basic research in Austria is still comparatively humble. Austria has positioned itself in the middle range of OECD countries. The main stakeholder for basic research in Austria is the HES, which accounts for 70%, while R&D investments of enterprises in basic research in Austria account for only below 4% of all their R&D expenditure.

3.4 Assessment of the policy mix

To compensate for the expected stagnation in the growth of public investment in R&D in the coming years in order to consolidate the public budget, it is ever more important to activate and optimally exploit the potential of private research financing, and to increase the efficiency of the innovation system in terms of its elements and links. Therefore, the Austrian Government’s RTDI Strategy stipulates that the private share in research intensity should reach at least 66% by 2020 (in order to attain the 3.76% objective). Although attractive support measures to stimulate R&D by the BES are in place, this objective is very ambitious given the low absolute number of enterprises with high R&D expenditure in Austria, the comparatively small high-tech sector in the economy, and the great dependency on funding from abroad which strongly correlates with overall economic business cycles, which for the next few years will most probably be restrained.

⁴⁵ Compare Schuch (2011).

In terms of the policy mix, the Austrian RTDI portfolio encompasses initiatives and programmes on all six routes, but structural challenges can be found on almost all policy mix routes.

Concerning the establishment of new indigenous R&D performing firms, enterprise formation dynamics in Austria has been improving for a couple of years, but R&D intensive firms are only part of the picture, and their contribution to accelerating structural transformation has been limited. The weakly developed venture capital market in Austria (especially in early-phase investment) is causally linked with this fact. In general, however, the environment for creating and supporting entrepreneurial behaviour has become more favourable, but general deficits remain regarding the legal security in the area of VCI companies, to be remedied by creating modern, internationally competitive legal conditions, and, secondly, by establishing role-models (profitable funds as success stories for other investment companies and investors). An example of this is the recently introduced venture capital/clean-tech initiative by AWS. To stimulate greater R&D investment in R&D performing firms, a reform of the tax allowance system was introduced which became effective as of 1 January 2011. Little can yet be said about its effects, but generally it is considered to be a very lean, less selective and generous instrument for corporate R&D. It is likely to stimulate greater R&D investment but will hardly change the uneven distribution of R&D expenditure in Austria, where 33 enterprises account for 50% of all public R&D subsidies.

Another means to stimulate more R&D is the stimulation of firms that do not perform R&D yet. To achieve this goal, Innovation Voucher models were implemented in Austria, which are subsidised to a very large extent by public money and hardly leverage additional private spending, at least not in the short term. The evaluation of this measure (Good and Tiefertaler 2011) revealed that smaller SMEs which used the Innovation Voucher were hardly able to access the “funding chain” provided by AWS and FFG. Most project-based follow-ups (41%) were again based on new Innovation Voucher applications (but - as regulated by the programme - with a different research partner, a fact criticised by the evaluators). In order to connect SMEs more closely with industrial research mainstream programmes of FFG, an upgraded “Innovation Voucher plus” scheme was introduced in 2011, with a small private co-funding share. Due to its novelty, its effects are not traceable yet.

Overall the number of research performing (or at least research contracting) companies in Austria is steadily increasing. The Austrian R&D survey 2009 already included 2,946 companies⁴⁶. This is an increase of almost 17% compared to the previous survey conducted in 2007.

The attraction of R&D-performing firms as well as of R&D funding from abroad is essential for the Austrian innovation system, but the relative share of funding from abroad is continuously decreasing. Its peak was the year 2002 with 21.39%, and it is around 16.20% in 2011⁴⁷. While corporate tax remains comparatively low in Austria

⁴⁶ Out of which 55 are from the cooperative sector (including AIT and Competence Centres).

⁴⁷ Companies which intend to expand their activities through new settlements or re-locations react sensitively to business cycles. Therefore it is not surprising that in 2009 company allocations to Austria came to a halt after a 5-year expansion phase. The Austrian Business Agency (ABA) was able to attract 158 international enterprises in 2009, which was a decline of 38% compared to 2008. Interestingly, more than 15% of these enterprises came from the BRIC countries, mostly Russia, which is an increase also in absolute terms and indicates a new trend owed to globalisation. 31 settlements were in the field of service industries, 14 in life sciences, 13 in tourism and 12 in the IT sector. Seven new companies are engaged in R&D only (ABA 2010). To attract more MNE to locate their R&D in Austria, mainly in the fields of environmental technologies, energy, life sciences and ICT, a marketing initiative has been launched: This

(also due to the pressure of neighbouring countries such as Slovakia), labour taxes are very high, which puts thumbscrews on the economy, especially in the service sector, while the productive industrial sector compensates part of this cost pressure successfully by mechanisation. Another advantageous financial framework is the system of group taxation (“Gruppenbesteuerung”, Sieber 2010). In policy discussions the deteriorating quality of education (evidenced by the mediocre PISA results of Austrian pupils) and the low number of graduates from the fields of STE are increasingly mentioned as major structural immaterial disadvantages for the future (Aiginger et al. 2009). Although this fear was not evidenced by Sieber (2010) concerning the present status-quo, a future-oriented economic policy should focus on further improvement in the area of skills and excellence to meet the demand of the future.

To ensure or even advance the attraction of R&D-performing firms from abroad, the local presence of universities and faculties that specialise in science and engineering will also most likely increase in importance (“R&D follows excellence”). Austria has a number of programmes in place to support science-industry relations, but serious shortcomings are perceived on the side of universities due to under-financing of basic research. The expert group preparing Austria’s “Higher Education Plan” points to the empirical correlation between limited radical innovation in the BES in Austria and limited basic research at Austria’s universities (Loprieno, A. et al, 2011). This assessment is based on Gersbach et al. (2008), who investigated the positive correlation between basic research and innovation, particularly when a country produced commodities and services close to the existing technological boundaries.

While the policy mix route to increase extramural R&D carried out in cooperation with the public sector is well developed in Austria and remains at a high level despite few new initiatives in the last three years, the policy mix route to increase R&D in the public sector is confronted with limited funding in basic research (despite a satisfactory output increase in terms of publications). The available research resources directly allocated to the universities are under pressure of becoming increasingly cannibalised by teaching activities due to a growing number of students. The share of funding distributed competitively also remains too low to contribute to an advanced profile building. Another matter for concern is the lack of a procedure to establish a national, harmonised and aligned research infrastructure plan.

A number of issues which would improve the organisational framework to support enhanced private R&D investments have been addressed by the Austrian Council in November 2011. Among its recommendations are

- the inclusion of technology transfer activities in performance agreements of universities,
- the introduction of formal return-options for failed academic spin-offs,
- the introduction of “proof-of-concept” measures,
- a generally more benevolent evaluation of risky projects,
- preferential fiscal treatment of capital used for venture capital and business start-up financing,
- an increase of the research premium (especially for smaller enterprises) and
- improvement of the services of the Austrian Patent Office.

should result in 25 new R&D headquarters in Austria and another 65 new allocations of companies with R&D functions (ABA 2010).

Table 2: Structural challenges

Challenges	Policy measures/actions ⁴⁸	Assessment in terms of appropriateness, efficiency and effectiveness
Weak human capital basis for innovation	<p>There are several policy measures in place, and much has been done in the last years in this respect. Educational issues are also a top priority of the newly established Research, Technology and Innovation Task Force. For reasons of space, only the most recent initiatives are mentioned:</p> <ul style="list-style-type: none"> • introduction of an industrial PhD Programme based on the Danish model; • more information provision for freshmen in the tertiary education system: http://www.studienwahl.at/ (already in place before the launch date of the Austrian RTDI strategy); • better targeted information for school-leavers with “Matura” from the secondary education sector (as of 2011): http://www.studienchecker.at/; • establishment of the Austrian Higher Education Plan (forthcoming); • the MINT (Mathematics, Informatics, Natural Sciences and Technical Sciences) information campaign to attract students to STE studies, which was launched in 2010 (http://www.mint.at/content/); • introduction of the “Neue Mittelschule” (new junior high model); • introduction of an obligatory year at kindergarten; • introduction of early language training subsidies (esp. for pre-school children); 	<p>To improve the stock of science and technology graduates, several initiatives have been launched or are being planned. However, an essential problem from the perspective of R&D policy - beyond the difficulties of keeping students in the system (and not producing drop-outs) and attracting them especially to MINT subjects (engineering and natural sciences) - is that the Austrian tertiary education system is faced with the basic problem that the quota of young people with “Matura” (which is the final secondary education exam that confers the right to study) entering the tertiary enrolment circle is already too low.</p> <p>Therefore, to improve the system effectively, the pre-tertiary sector has to be reformed. Recently several large reform initiatives have been launched in this respect, like the “Neue Mittelschule”. In general one can say that a decades-long agony in education policy seems to be coming to an end.</p> <p>Further important steps would be to extend the system of universities of applied sciences and to establish a better division of objectives and functions within the university sector as stipulated in the framework report for the Higher Education Plan.</p>

⁴⁸ Changes in legislation and other initiatives not necessarily related to funding are also included.

Challenges	Policy measures/actions ⁴⁸	Assessment in terms of appropriateness, efficiency and effectiveness
Limited corporate R&D funding	<p>Despite the fact that private R&D funding is considered to be the most essential element to reach the 3.76% R&D target in Austria by 2020, little additional stimulus has been provided to companies to increase R&D expenditure and their share of R&D financing during the last three years. This is not surprising, however, because the available portfolio of instruments is already advanced, and the share of public financing of R&D in the BES sector is among the highest in Europe.</p> <p>Among the recent policy measures are:</p> <ul style="list-style-type: none"> • reform of the tax allowance system which enables a higher public funding quota and a simplification of the system; • introduction of the new Innovation Voucher plus scheme to accelerate the entry of SMEs in R&D activities and to familiarise them with the standard mainstream programmes implemented by FFG; • establishment and decision on the future extension of the Josef Ressel Centres to bridge the gap between industrial needs and research opportunities at universities of applied sciences. 	<p>During the last three years the share of R&D financing from the business-enterprise sector has been stagnating (with increasing R&D expenditure in absolute terms), in the face of a slightly but steadily declining share of corporate R&D funding from abroad (although still from a high level). This has been partially balanced by a transfer of a relatively high amount of public funds into the corporate R&D sector (compared to the EU average), and based on a well-developed science-industry cooperation portfolio. The impact on structural economic change in terms of added-value and high-tech orientation has remained limited. It has not been possible to remedy the strong concentration of R&D expenditure (incl. public R&D appropriations) on relatively few companies. R&D financing of companies for basic research remains very limited.</p> <p>Innovation procurement has just started to advance from the level of a policy of promises to an operative procedure, with a first pilot initiative implemented by FFG in the field of mobility.</p>

Challenges	Policy measures/actions ⁴⁸	Assessment in terms of appropriateness, efficiency and effectiveness
Competition bottlenecks	<p>The most recent public initiatives in this field were primarily focused on mobilising private risk capital to enhance access to financing young, innovative SMEs in the early stages, and to improve the technological capacities of growing companies:</p> <ul style="list-style-type: none"> extension of the “aws-Mittelstandsfonds” for financing significant projects in the growth stage of medium-sized enterprises in Austria; Venture Capital/Clean-tech Initiative, a very recent fund-in-fund initiative focussing on mobilisation of private risk capital through participation in privately organised venture capital funds based on common sectoral standards, with the ultimate goal to provide risk capital to enhance access to finance for Austrian SMEs in the early stages. The Venture Capital Initiative targets R&D businesses with a focus on start-ups, while the Clean-tech Initiative targets the development and commercialisation of innovative products/services/processes, focusing on renewable energy, energy efficiency and other green technologies; continuation of the JITU initiative consisting of three modules: PreSeed; Seed Financing; and Temporary Management; continuation of consultancy services focusing on support of IPR protection and exploitation; i2-market for business angels, and enterprise-formation services. 	<p>The last years were characterised by low domestic private demand (both in terms of investments and private consumption) and limited export orientation towards emerging countries.</p> <p>Despite a few improvements (e.g. a new railway company operating on the most highly frequented route in Austria), low competition intensity remains in certain service sectors. Moreover, there is still sporadic limited competition in the productive sector (e.g. through cartel formation), and the start-up dynamics of innovative companies to advance competition intensity in established industries is low.</p> <p>Despite advances in venture and equity capital financing, the legal environment for venture capitalists has not been improved yet.</p>

4 National policy and the European perspective

Austria’s RTDI policy and its national policy mix are aligned with the ERA pillars and objectives to a large extent. Austria is a small, but open economy, also in terms of its labour market. There are hardly any codified restrictions for researchers from abroad (especially from the EU) to move to Austria for work, but fundamental deficits in terms of (faster) recognition of educational achievements attained abroad remain⁴⁹. The

⁴⁹ <http://derstandard.at/1263705448850/Integration-Viele-Zuwanderer-sind-fuer-ihre-Arbeit-ueberqualifiziert>, accessed on 14 February 2012

immigration laws for qualified personnel have been considerably improved recently by introducing the “Rot-Weiss-Rot-Karte” (“red-white-red card”), inspired by the U.S. green card, in 2011. Especially public research organisations can easily benefit from improved immigration regulations. Third-country students who graduated in Austria are now allowed to enter the Austrian labour market directly.

Cross-border cooperation and European knowledge transfer are well established, both at the level of researchers, research organisations from industry and academia, and research funding agencies. In the field of basic research, there is a high propensity and readiness to finance also research conducted outside Austria. FWF, Austria’s largest basic research fund, has already spent more than 10% of its funding abroad. Austria is involved in a large number of ERA-NETs, which contribute not only to a more efficient allocation of funding but also to enhanced cross-border relations with researchers from other EU Member States. However, due to the limited involvement of some of Austria’s neighbouring countries in ERA-NETs and other European cross-border initiatives, these programmes have not yet been made the best use of in order to capitalise on the potentials of cross-border cooperation. Unilateral initiatives to counterbalance these shortcomings have been gradually downsized during the last couple of years.

Austria has sufficient basic scientific infrastructures in place, but only a very limited number of internationally recognised ones. Although Austria has actively committed itself to participating in several ESFRI initiatives, the absence of an aligned research infrastructure strategy, which has repeatedly been requested by the Austrian Council (2011), makes a coordinated local, national, regional, European and international approach more difficult. A public consultation⁵⁰ on research infrastructures (RI) and a repository⁵¹ of RI in Austria have been commissioned by the Austrian Council to create pressure in favour of a faster resolution of this issue. The availability of, and access to, research infrastructures represent a bottleneck for the development of research in Austria.

In terms of research organisations, much progress towards autonomy (also in financial terms) has already been made in the university sector in the last decade. However, there is a need to reform the university financing model and to make research financing in general more competitive and project-based. This should also lead to the establishment of more pronounced individual profiles of universities with clusters of excellence. The cooperation and division of labour (and objectives) between universities and the non-university sector (incl. universities of applied sciences) still leaves room for improvement. By now the government does not provide sufficient practical incentives to improve coordination and profile-building. There are also hardly any performance agreement systems in place for non-university research organisations, which is partly due to the lack of significant indicators capable of covering the thematic wealth of the non-university research sector in Austria.

The promotion of collaboration between science and business since the 1990s has given rise to a broad spectrum of successful institutions alongside universities and enterprises. They comprise – among others - the COMET programme’s Competence Centres, the CDG Laboratories, a reformed Ludwig Boltzmann Society, a reformed Austrian Institute of Technology, and the Austrian Cooperative Research (ACR). Recently they have been joined by Josef Ressel Centres and Laura Bassi Centres of Expertise. There is still room for improving appropriate entrepreneurial and content-based

For a more detailed analysis see Breinbauer, A. and Gächter, A. (2007).

⁵⁰ forschungsinfrastruktur.cbased.com

⁵¹ Austin, Pock und Partners (2010)

competencies in innovation and knowledge management, both in firms as well as in science and research institutions.

As regards knowledge transfer, knowledge sharing and open access as key ERA dimensions are well established in Austria. Regarding open access, all major research funders are signatories of the Berlin (2007) Declaration on Open Access to Knowledge in the Sciences and Humanities. Like the majority of EU countries, Austria addresses knowledge transfer through overarching laws on the research system, obliging both research funders and public research organisations to play a full role in supporting national innovation and competitiveness (ERALAW 2011). Researchers from public organisations are entitled to patent their inventions, provided that their employer is not willing to file the patent application himself or herself. Austria has special regulations, based on soft law, that guide research funding organisations when supporting academic spin-offs agglomerated in special centres called "A plus B" Centres. These guidelines offer advice on a variety of relevant areas, including management, eligibility, and funding for such activities (ERALAW 2011).

In terms of R&D funding the Austrian funding portfolio is still focussed on technological research and technology transfer, while only recently more emphasis has been directed towards non-technological innovations in manufacturing and in the service sector. Public sector innovation and social innovations are not tackled by the existing funding portfolio. Innovation procurement is still at a pilot stage (pre-commercial procurement in the field of mobility).

As an open small economy, Austria is well engaged in international R&D exercises and participates in international large-scale research programmes such as CERN, ESRF, EMBO, CISM, ILL, ELETTRA, IIASA, ISTC/STCU, WMO, and has signed intergovernmental bilateral S&T agreements with China, FYR of Macedonia, India, Korea, Croatia and Ukraine. Austria's main area of cooperation is support for the mobility of researchers, based on jointly defined projects. However, most of the existing internationalisation programmes are subcritical and rarely facilitate comprehensive research collaboration. To add critical momentum, Austria successfully participates in international INCO-NETs to establish and support the policy dialogue with third countries. It also participates in a number of international ERA-NETs to fund research activities with third country partners. However, there is hardly any involvement of more applied and industry-oriented funding partners under these schemes.

Table 3: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	Labour market for researchers	There is no comprehensive introduction of a tenure track system at universities, which results in a very large share of competitively financed research positions with temporary contracts. Such temporary positions (very often on a part-time basis) are also often to be found in the non-university research sector. Female researchers are still underrepresented, especially in industrial research and – despite some improvements in recent years – in the highest university positions (incl. the Academy of Sciences).	<ul style="list-style-type: none"> • establishment of a ‘red-white-red card’ to facilitate the immigration of highly skilled personnel to Austria. • liberalised labour market access for third-country graduates from domestic universities.
2	Cross-border cooperation	There are only minor challenges which concern a rather sporadic (rather than regular) policy dialogue at the level of policy-makers with their counterparts in the neighbouring countries (beyond the European dimension and forums). More dialogue and alignment could eventually lead to a better utilisation of Structural Funds (e.g. transnational programmes). Moreover, some of Austria’s neighbouring countries invest little in ERA-NETs and other cross-border initiatives, which limits potential of cross-border cooperation.	<ul style="list-style-type: none"> • Due to budget restrictions, the Austrian Science and Research Liaison Offices (ASO) in Central and Southeast Europe were gradually closed down during the last years. The last operating ASO in Ljubljana was abandoned on 31 December 2011. • The CIRCE programme, a unilateral initiative funded entirely by Austria to stimulate RTDI cooperation between Austrian SMEs (and academia) with partners in Southeast Europe and Eastern Europe has been subsumed under the COIN programme, with shrinking uptake in the last call for proposals.

	ERA dimension	Main challenges at national level	Recent policy changes
3	World class research infrastructures	<p>Austria still lacks a harmonised and aligned national research infrastructure plan. Instead of providing enough resources via institutional funding to guarantee a basic R&D infrastructure, this kind of investment quite often has to be financed through competitively acquired projects.</p> <p>Although stock-taking of RTDI infrastructure needs has already taken place, there is still no synergetic approach which takes into account existing infrastructures (and needs) both from the university and the non-university research sectors and their joint usage.</p> <p>Austria has only a very limited number of research infrastructures with international visibility.</p>	<ul style="list-style-type: none"> Based on a study, the Austrian Council for RTD conducted an online consultation in October 2011 to come up with policy recommendations in November 2011 on how to approach the issue of research infrastructures better in the future. Among these recommendations are: <ul style="list-style-type: none"> – establishment of an infrastructure contact point; – operation of a diversity of financing modes; – establishment of a strategic platform to work out a roadmap; – elaboration of a national research infrastructure strategy. The framework concept for the Austrian Higher Education Plan also proposes an outline for approaching an aligned infrastructure roadmap.

	ERA dimension	Main challenges at national level	Recent policy changes
4	Research institutions	<p>A major challenge is to overcome the limited cooperation between universities and non-university research organisations as well as between the universities and the universities of applied sciences.</p> <p>Performance contracting has been introduced in the university sector, but is not yet universally applied in the non-university research sector.</p> <p>A further challenge is the insufficient structural funding for larger private non-profit research organisations which carry out essential research-based services for society (e.g. in the social sciences).</p> <p>The available competitive funding is too limited to contribute to a differentiation of the research system in Austria based on excellence.</p> <p>In general, financing for basic research has been comparatively static during the last 10 years.</p>	<ul style="list-style-type: none"> establishment of a performance agreement for the Austrian Academy of Sciences (Austria's largest non-university research organisation); granting of a lump sum percentage for overhead costs on certain project types introduced by FWF in 2011; preparation of a national Higher Education Plan including a reformed financing model (still under discussion); termination of structural funding for many private non-profit research organisations as of 1 January 2011, due to budget restrictions; re-positioning of the Austrian Institute of Technology (formerly Austrian Research Centres) in 2010; strategy process in Joanneum Research concluded in 2011.
5	Public-private partnerships	<p>Although many science-industry programmes are available in Austria, more emphasis should be put on excellence, sustainability and on less risk-adverse projects. The "proof-of-concept" approach has not yet been introduced in the Austrian research funding portfolio either.</p> <p>Barriers for cooperating with research institutions must be removed to make it easier for innovative firms to access external facilities.</p> <p>Know-how and technology transfer are not yet an established third dimension within the university sector (they are not taken up in performance agreements).</p>	<ul style="list-style-type: none"> establishment of Josef Ressel Centres and Laura Bassi Centres of Expertise; moving away of Austria's Research Promotion Agency from a programme management approach towards a more advanced "theme management" approach (still ongoing).

	ERA dimension	Main challenges at national level	Recent policy changes
6	Knowledge circulation across Europe	<p>According to the Austrian Council for RTD, the services of the Austrian Patent Office need to be improved.</p> <p>Moreover, the available co-financing models to participate successfully in transnational ERDF programmes (e.g. Alpine Space, CE and SEE programme) are hardly organised and rather arbitrary.</p>	<ul style="list-style-type: none"> abolishment of FP7 project preparation funding (and re-introduction of a similar funding scheme for a narrow target group through the "top-EU" programme).
7	International cooperation	<p>Austria has many internationalisation programmes, but almost all of them are lacking critical mass. Therefore it is essential to pool resources with other European partners (e.g. in international ERA-NETs), especially when rather new cooperation targets (e.g. BRIC countries) are envisaged.</p> <p>Moreover, more applied and industrial-oriented funding partners from Austria need to become engaged in international ERA-NETs with a stronger application focus.</p>	<ul style="list-style-type: none"> stronger focus on BRIC countries in the government's RTDI structure than previously; closing-down of the Austrian Science and Research Liaison Offices in Central and Southeast Europe; establishment of the "appear" programme to support research for development.

Annex: Alignment of national policies with ERA pillars / objectives

1. Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers

1.1 Supply of human resources for research

According to Statistik Austria⁵² (data for 2009), the R&D personnel in Austria has a headcount of 96,592, out of whom 59,341 are researchers, 26,997 are more highly qualified non-scientific personnel (incl. technicians) and 10,164 are auxiliary personnel (all headcounts). In full-time equivalents (FTE), R&D personnel amounts to 56,437.5 in total, out of whom 34,663.7 are researchers, 16,708.6 are more highly qualified non-scientific personnel (incl. technicians), and 5,065.2 auxiliary personnel.

Most researchers are employed in the BES (21,599.0 FTE), followed by the HES (11,262.0 FTE), the public sector (1,559.3 FTE), and the private non-profit sector (243.3 FTE). In terms of FTE, $\frac{3}{4}$ of researchers in Austria are male (all data from 2009). This imbalance is particularly pronounced in the corporate sector; there only 15% of researchers are women. To counterbalance this disproportional distribution, several support measures have been implemented for many years, with some success in the public and HES sector but little impact in the corporate sector as yet. The corporate sector is especially addressed by the FEMTECH initiative, and recently the Laura-Bassi Centres of Expertise have been established to support – among other objectives - female researchers at the science-industry interface. A recent interim evaluation of this programme emphasised the complexity of the task of balancing excellence and management objectives (incl. career opportunities for women), a task which, however, seems to be successfully addressed by this programme (Dörflinger and Mayer 2011).

The share of human resources in S&T (HRST) in % of the working population aged between 25 and 64 years, defined as population either with a tertiary education *or* employed in a scientific or technical occupation, was 39% in Austria in 2010 and corresponds to the EU-27 average of 40.5%. Apparently, only a small share of this population is engaged in R&D. If a more narrow core definition is applied, namely when only considering a population with tertiary education who is also actually working in a scientific or technical occupation, then this share in Austria is 11.5% (2007), which is considerably lower than the EU average of 17.1% (BMWF, BMVIT, BMWFJ, 2010).

R&D personnel in the BES consists of only a minor share of post-docs (16.3%), which mirrors the medium technology and hi-tech-medium technology orientation of the Austrian economy. In order to increase the supply of scientifically trained personnel in the BES, the young experts support measure substantially subsidises the personnel costs of bachelors, masters, PhD candidates, junior researchers and even post-docs working in the BES. 45.1%, of the R&D personnel employed by the BES have tertiary education at master or bachelor level. A relatively large share (25.4%) is personnel with only a completed secondary sector education⁵³.

According to Schibany and Gassler (2010), the number of employees at Austrian universities increased by 23% to around 50,000 between 2005 and 2009, while the number of FTEs increased only by 17 % to 34,000. On the other hand, the number of full professors remained almost the same. A larger share of this rise in the number of employees is caused by an increase of personnel funded through third-party funds, whose growth was 44% (FTE) or 61% (headcounts) respectively. A trend towards part-time employment of non-habilitated personnel at universities can be found among mid-level faculty. These persons usually have only temporary employment contracts and restricted tenure track perspectives.

⁵²

http://www.statistik.at/web_de/statistiken/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html, accessed on 3 February 2012

⁵³

http://www.statistik.at/web_de/statistiken/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html, accessed on 3 February 2012

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and that barriers to cross-border mobility are removed

Compared to the EU average of 32.6%, Austrian researchers are considerably more frequently subject to temporary employment contracts (53.4%). The share of researchers in part-time employment is also above the EU average (BMWF, BMVIT and BMWFJ 2011 based on MORE data⁵⁴). This is especially true for the early phases of research careers in Austria and might partly also be caused by a change of legislation in Austria, because until the establishment of a collective agreement for universities on 1 October 2009, newly employed researchers in Austria were subject to being employed according to the “Vertragsbedienstetengesetz” (Federal Contract Staff Act) which automatically provided temporary contracts (BMBWK 2006).

R&D mobility is supposed to yield positive effects both at the individual as well as at the macro-economic level. Within the EU, R&D mobility should also contribute to overcoming fragmentation through increased exchange of knowledge (European Commission 2008; Macguiness and O’Carrol 2011). These objectives have also found their way into the Innovation Union initiative. According to the MORE project, Austrian researchers in the HES are not as mobile as the EU average (51% vs. 56%). Still one can summarise that episodes of mobility are common also in an Austrian researcher’s career. Male Austrian researchers are particularly mobile (76% compared to 67% in the EU) (BMWF, BMVIT and BMWFJ 2011).

According to the MORE study, Austria’s attractiveness as a country for inward mobility is only middle-of-the-range, despite the fact that salaries for R&D paid in Austria are competitive (CARSA 2007). This mediocre level of attraction might be caused by insufficient career track opportunities in Austria (with a persistent number of full professorships, which is, however, limited in quantity) and limited possibilities for independent research for young researchers (Janger und Pechar 2010). Nevertheless, Austria has a large share of foreigners among its HRST. Every year between 0.4% and 0.7% of all employed HRST in Austria immigrate to Austria, which is above the European average (BMWF, BMVIT, BMWFJ, 2010). While in the EU on average 0.3% of HRST (in the core definition) in 2007 had worked abroad one year before, this share in Austria is almost twice as high (0.59%). This is mainly due to a level of immigration of people with tertiary education to Austria which is considerably above the EU average. Austria thus partially makes up for its low share of a population with tertiary education (Schuch 2011). However, like in most small European countries, a remarkable share of Austrian-born HRST also lives abroad. According to the European working force census (2007), 0.8% of all Austrians are working in other EU countries.

Overall, both the mobility of researchers and support for internationalisation through the opening up of the labour market for researchers are well developed in Austria. Non-Austrians are eligible when competing for permanent research and academic positions. Depending on the funding programme, research grants are also partly portable and can be transferred by the grantee to another national or foreign institution. This is particularly the case for grants provided on an individual merit base, where the applicant is an individual researcher and not a research organisation (like in the case of most FWF-grants). If this is not the case, agreements have to be negotiated with the research organisation (Schuch 2011).

In order to substantiate Austria’s aspiration to become a “frontrunner” in R&D, measures have been launched in recent years to attract foreign researchers and expatriates, as well as supporting the mobility of Austrian scientists. Austria was also among the first European Countries to adopt both the EC directive on researchers’ visas and install a Researchers’ Mobility Portal. The Austrian Federal Ministry of Science and Research (BMWF), the former Austrian Rector’s Conference, the Austrian Agency for International Cooperation in Education and Research (OeAD), the Austrian Science Fund (FWF), the Association of Universities of Applied Sciences, the platform “Forschung Austria”, Joanneum Research and the Ludwig Boltzmann Society, as well as another 20 public research organisations have already signed the Charter for Researchers, which covers a very large share of public research providers in Austria.⁵⁵

Universities are free to contract researchers based on private law. However, the dependency of many new positions on project based third-party funds and a general reluctance of universities as employers to award unlimited contracts have led to a stronger increase of temporary contracts compared to tenure-track

⁵⁴ See CARSA 2007.

⁵⁵ <http://ec.europa.eu/euraxess/index.cfm/rights/charterAndCode>, accessed on 3 February 2012

positions⁵⁶. Most lecturers and teaching assistants are usually working under temporary contracts. The non-university research sector depends to a considerably larger extent on third-party funded projects than universities. As a consequence, temporary contracts are more frequent, although labour law regulations prohibit their being used repeatedly. In general, however, even regular ("permanent") contracts can be easily terminated in Austria. Therefore, the main problem for many researchers working outside the limited number of regulated tenure-track positions is to procure new research funding to secure employment (Schuch 2011).

The Austrian system has fully opened itself up to foreign researchers concerning residence and work permits, but does not distinguish between researchers and other employees when it comes to social security. This means that there is no special treatment of foreign researchers in terms of social security, pensions or health insurance. Eligibility for social security benefits depends on the employment contract. In a regular employment contract, all researchers, irrespective of their origin, are subject to social and health security contributions and to labour tax, unless there are individual special delegation provisions by a foreign employer. Length of stay and the type of contract held determine the type of social security applied in each case (Schuch 2011).

Austria's latest labour laws (2011) are very general regarding equal treatment in recruitment and employment, covering all labour minorities and professions throughout the country. Austrian universities also have their own internal equal treatment units, whose operations are aligned to the overall equal treatment law and regulated under the Universities Act 2002 (ERALAW 2011). "Task forces" for fair and equal gender treatment have been established in every university. The Universities Act also regulates the procedure for appointing and promoting academics and makes no distinction between Austrians and non-natives. Regarding soft law, there is a collective standard of employment that universities voluntarily sign up to regulating certain provisions regarding pensions, salary schemes, working hours, business travel, vocational training etc. There is also a similar agreement for the non-university research sector, which is voluntary (ERALAW 2011).

1.3 Improve young people's scientific education and increase interest in research careers

The share of completed doctoral degree programmes in Austria is high compared to the OECD and EU average, which would indicate a relatively high potential for R&D activities. In 2009, 2,284 new PhDs graduated in Austria⁵⁷. However, the traditional Austrian doctoral degree programme does not equal a full-fledged research-oriented PhD study programme and does not in each and every case lead to acquiring competency for conducting independent research, due to the sometimes weak supervisory role of the "doctor father" (doctoral thesis supervisor), the loose integration of the PhD student into the faculty, and the as yet insufficient supply of top-end courses to increase the methodological research competency of the PhD student. Not surprisingly, the official "research maturity" in Austria is attained only with the "Habilitation" (post-doctoral lecture qualification) (BMWF, BMVIT, BMWFJ 2010). The FWF concludes that Austria is educating an above average share of doctoral students, many of whom do not receive a professional scientific education and training and are not adequately integrated into the science system (FWF 2010).

Against this background, doctoral education is undergoing reform. The Universities Act 2002 provides a new legal basis for the reform of doctoral education in Austria. This shift is also being made in response to the Bologna Process.

In order to increase the quality of doctoral education, more than half of the universities have committed themselves in their performance agreements to establishing new doctorate programmes (FWF 2010). Admittedly, the implemented design approaches for the doctoral study programmes show a great degree of variety and often do not meet the criteria of professional, structured doctoral education programmes (FWF 2010). The financing and social security of doctoral students remains one of the core problems. The number of fellowships or employment contracts granted under doctoral degree programmes is still low compared to the overall number of doctoral students, and the net of graduate schools at the Austrian universities is far from being close-meshed. The majority of the fellowships granted are quite marginally endowed too. Foreign doctoral students can also participate in the doctoral degree programmes and/or schools if they are

⁵⁶ Interview with Professor Ulrike Felt in "Der Standard" on "Der Umgang mit dem Nachwuchs ist nicht ehrlich" ("The handling of young people lacks honesty"), 23 February 2011, p. 14.

⁵⁷ Eurostat, accessed on 7 November 2011

rightfully enrolled at a domestic university. English classes are still only offered in exceptional cases, but their extension is foreseen in some of the performance agreements of the universities (Schuch 2011).

1.4 Promote equal treatment for women and men in research

Although more than half of all university graduates and nearly 42% of all PhDs are women, their level of participation in research careers is among the lowest in the EU. This is especially the case in the BES. The representation of women in leading positions is also very low. This “leaky pipeline” phenomenon is blatantly visible. Austria has one of the thickest “glass ceilings” in the EU, although a look at other economic or societal sectors reveals that it is not restricted to careers in R&D (Tiefenthaler 2009, Schuch 2011).

Although the law prescribes that maternity leave must not be a discriminating factor in Austria, statistics also reveal that children are a risk for careers (Lind and Banavas, 2008). The long grace period for maternity leave and the lack of nursery schools and kindergartens in Austria have led to a gradual retreat of women with young children from the labour market. A voluntary long maternity leave is also supposed to lead to de-qualification and leads to lower scientific output in any case. The law stipulates that women have the right to return to an equal (not necessarily the same) position to the one held before their maternity leave. There are some other precautions deemed to be advantageous for reconciling work and family life (but not necessarily for career advancement), such as that women are for instance legally entitled to have a part-time position when they end their maternity leave. Pregnancies also automatically freeze temporary contracts in Austria unless there are legal reasons or unless this is duly justified (Schuch 2011).

Austria has put various measures in place to increase the rate of women in science and industry. In the Universities Act a women quota in university committees of 40% is stipulated. This entered into force on 1 October 2009. Activities encompass a variety of measures, such as human resource development measures, recruiting of female scientific personnel, and implementation of gender monitoring and gender budgeting. A number of instruments have also been launched under the umbrella of the inter-ministerial action programme “forte” (“Women in Research and Technology”), to counteract the low rate of women in R&D.

2. Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding⁵⁸

Austria is well integrated in jointly funded initiatives at European level. Out of a total of 69 granted projects funded under the ERA-NET scheme, Austria participates in 38 projects with 48 participations⁵⁹. 83% of these Austrian participations are engaged in 31 ERA-NET type projects (PROVISO 2011). In a comparative EU analysis, Austria ranks seventh in these projects among all EU countries. However, only two approved ERA-NETs are coordinated by Austrian institutions (which is 6th rank, together with Denmark and Spain). In absolute terms, Austria is most engaged in international ERA-NET projects and in ERA-NET projects in the field of FAFB (food, agriculture, fisheries and biotechnology), followed by NMP (nanosciences, nanotechnologies, materials and new production technologies). Relatively speaking, there is also a high level of engagement in the fields of energy research and ICT. Within the ERA-NETs with Austrian participation, Austria collaborates most with France and Germany. The collaboration with the Central European neighbouring countries is comparatively low, a fact which is caused by the general low involvement of these countries in ERA-NETs. The most active participants in the ERA-NET scheme are the Austrian Research Promotion Agency (FFG), BMWF, BMVIT, FWF, ZSI and BMLFUW (PROVISO 2011). In addition, 9 ERA-NET PLUS projects have been approved. Austrian institutions participate in 5 of these. One of them is coordinated by the Austrian Centre of Social Innovation (Southeast European ERA NET PLUS).

⁵⁸ Promote more critical mass and more strategic, focussed, efficient and effective European research via improved cooperation and coordination between public research funding authorities across Europe, including joint programming, jointly funded activities and common foresight.

- Ensure the development of research systems and programmes across the Union in a more simple and coherent manner,
- Promote increased European-wide competition and access of cross-border projects to national projects funding.

⁵⁹ The cut-off date is January 2011.

The FWF and the Austrian Academy of Sciences are members of the European Science Foundation (ESF). The FWF also participates in $\frac{3}{4}$ of the "European Collaborative Research Programmes" (EUROCORES), the thematic research programmes of the ESF (Schuch 2011). For the time being, Austria is participating in the Art. 185 initiatives "Eurostars", "Ambient assisted living", and the European Metrology Research and Development Programme ([EMRP](#)), as well as in the Joint Programming Initiatives⁶⁰ "Agriculture, Food Security and Climate Change", "A Healthy Diet for a Healthy Life", "Urban Europe", "CLIMATE Connecting Climate Knowledge for Europe" and "More Years, Better Lives" (formerly known as "Health & Ageing"). Austria's participation in the JPI "Neurodegenerative Disease Research" is still under discussion. Austria has observer status in the JPIs "Cultural Heritage and Global Challenge: A new challenge for Europe" as well as "Water Challenges" (BMWF and FFG 2011). Austria is founding member of the public-private partnership-based JTI "Artemis"⁶¹ and engaged in ENIAC, which aims to ensure that Europe realises its potential in new markets for intelligent products, processes and services by achieving world leadership in nano-electronics. The FFG implements the national JTI project administration, and the BMVIT contributes financially (Schuch, 2011). Coordination and cooperation among those who develop and manage research programmes has been reinforced to increase the efficiency and impact of national public research funding also outside these ERA-instruments, e.g. through the D-A-CH Agreement, a cooperation activity between research funding agencies in Germany, Switzerland and Austria. The opening up of national R&D programmes depends on the programme "owner", but in general one can summarise that Austria has rather a laissez-faire approach in this respect. In Austria the territorial principle applies, but a full-fledged definite strategy to tackle the issue of "opening-up" does not exist. The major corner stones of the territorial principle are having Austrian legal status (e.g. a branch of a foreign company with a registered address in Austria) or a residence in Austria (e.g. a foreign researcher). Regarding the opening-up of national R&D programmes, the principle of non-discrimination of foreigners on Austrian territory also applies. This already rather liberal approach can be further softened up, as long as an advantage for the national economy can be justified (Schuch, 2008). With such a justification, which is highly context-dependent, non-nationals working abroad or nationals working in another country can also participate in nationally funded R&D programmes and even receive a share of funding. It does not matter if in such cases the partners reside in EU countries or not.

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

As regards RI in Austria, the assessment of the Austrian Council for RTD mentioned in its 2020 strategy is still valid (Austrian Council 2009). The Council confirmed its recommendations made at that time again in November 2011 – also based on an inventory published in June 2010 (Austin Pock and Partners 2010): to step up efforts to connect Austrian R&D closer with international infrastructures, to plan research infrastructures in a more integrative manner through the implementation of a national research infrastructures platform and a national contact point, which should prepare a national research infrastructure roadmap embedded in a long-term master plan, and to secure adequate financial resources sustainably (Austrian Council 2011).

According to Ms. Vierkorn-Rudolph (2010), ESFRI chair, Austria participates in CESSDA, CLARIN, SHARE, BBMRI, ECRIN, FAIR and PRACE. Overall, Austrian ESFRI participation shows a strong orientation towards social sciences and humanities as well as towards biological and medical sciences.

4. Strengthen research institutions, including notably universities

22 public universities, 21 universities of applied sciences and 13 rather small private universities were operating in Austria in November 2011. The public universities are the backbone of basic research in Austria. Their traditional missions are teaching and research, but they have been increasingly expected to cooperate with companies and other partners from practice. Universities of applied sciences ("Fachhochschulen") have been established in Austria in order to diversify tertiary education and to meet the demands of the labour market. Their main task is tertiary, practice-related education (ERAWATCH Network 2010).

⁶⁰ <http://www.era.gv.at/space/11442/directory/11767.html>; accessed on 3 February 2012.

⁶¹ "Advanced Research and Technology for Embedded Intelligence and Systems"

To support quality assurance in the HES in Austria, the Austrian Agency for Quality Assurance (AQA) was established as an autonomous institution in 2004, as a joint initiative of the former Austrian Rectors' Conference, the Austrian Conference of Universities of Applied Sciences, the Austrian Union of Private Universities, the Austrian National Union of Students and the former Federal Ministry for Education, Science and Culture. AQA is a full member of international networks for quality assurance (ENQA, CEE network and INQAAHE) and is registered in the European Quality Assurance Register for Higher Education. As one of the first European agencies AQA underwent an external evaluation co-ordinated by ENQA in 2007 (Schuch, 2011).

External accreditation of university courses is not required in Austria.

Austrian universities are autonomous to a very high degree. The development towards autonomy started already with the Universities Act 1993, with the separation of decision and control functions and the introduction of global budgets. Comprehensive personnel responsibility for universities was attained in 2001 with the service law for university teachers ("Universitätslehrerdienstrecht"). Finally, with the Universities Act 2002, all universities became autonomous legal entities of their own ("Vollrechtsfähigkeit"), guaranteed by the constitution (Art. 81c B-VG (Federal Constitution Act)). The control of legality is still a task of the state, but universities do business and conclude contracts on their own behalf and in their own right. The universities have financial autonomy in terms of global budgets based on performance agreements with duration of three years. In return, cost accounting and planning as well as intellectual capital reports have become compulsory (Schuch, 2011).

80% of the block funding granted to universities are "institutional funding" and 20% are a formula-based budget allocation. Eleven criteria are considered in the calculation of the formula budget, which are subsumed under three overall blocks (1) education, (2) R&D and (3) social objectives.⁶² Currently there are discussions to put more emphasis on research parameters such as bibliometric indicators, which would lead to more competition among the universities in this field and eventually to excellence-based priority-setting and concentration processes within a university and between competing universities (Schuch, 2011). The distribution of the money within the university is left to the universities themselves, which means that they could make decisions for allocating resources autonomously, in line with their research priorities. The process of establishing R&D priorities, however, is still in its exploratory phase and is still rather the exception than the rule (Wissenschaftsrat, 2010).

The restrictions imposed on universities regarding decisions about the admittance of students and influence on the number of study places, are still being discussed. Open access to universities has led to several massively attended subjects with several hundred freshmen which overburden the given capacities in terms of teaching, infrastructure, and personnel resources (Schuch, 2011).

Universities of applied sciences have been organised under private law from their inception. They have financial autonomy, but the state is responsible for the financing of the study places on the basis of the norm cost model. Contrary to universities, universities of applied sciences can regulate the admittance of students autonomously.

5. Facilitate partnerships and productive interactions between research institutions and the private sector

The highest level of representation of industry in Austria's RTD governance can be found in the Austrian Council for Research and Technological Development, which is actually chaired by a reputed Austrian industrialist. Three of the eight members of the Austrian Council are working in the private sector. Moreover, the private sector is also perceptibly represented in the University Councils, because by law this committee should consist of members with responsible positions in society, especially from science, culture, and the economy (Schuch, 2011).

In general there are no hard facts that restrict the mobility of researchers between the public and the private sector. Researchers employed in the public sector are allowed to work for industry on a part-time, consultancy or other basis, provided that their contracts do not include competition clauses which prohibit such arrangements. However, such clauses are valid in both directions. Through the gradual abolishment of

⁶² Verordnung der Bundesministerin für Bildung, Wissenschaft und Kultur über das formelgebundene Budget der Universitäten in der Fassung vom 22.11.2010 (Decree of the Minister of Education, Science and Culture on the formula-based budget of universities, as of 22 November 2010)

civil servant status at universities and the introduction of private law-based labour contracts, further mobility obstacles have been removed in the last years (Schuch, 2011).

However, various soft factors still make inter-sectoral mobility more difficult. For instance, the number and quality of publications is becoming increasingly central for access to an academic position as well as for career promotion. This constitutes a systemic inter-sectoral mobility dilemma because industry researchers are less stimulated or even not allowed to publish the results of their work. The necessity of more permeability between the university sector, the non-university research sector and the corporate sector was repeatedly addressed during the Austrian Research Dialogue (BMWF 2008). Most likely inter-sectoral researcher mobility is still low in Austria, and thus in line with the European mainstream (Schuch, 2011). The problem of missing links between science and industry, which has been perceived as one of the most crucial systemic problems in Austria in the 1990s, has been largely resolved through the introduction of a large number of instruments and interventions. The “Competence Centres” programmes (now COMET) have been the most visible among the many programmes which operate at the interface of science and industry (Schuch, 2011).

Since 2001, the publicly funded AplusB programme, which counts among the numerous science-industry programmes, supports spin-offs from universities, universities of applied sciences and non-university research organisations.

Based on the Universities Act of 2002, universities have become entitled to drive the capitalisation of their intellectual property. They have the possibility to take up and capitalise service inventions and results of scientific work of their personnel (§106 UG 2002). If a patent can be economically exploited, then the inventors receive a compensation which is relatively high by international comparison. If the university does not react within three months, then the inventor himself or herself has the right to make use of his or her exploitation right (Schuch, 2011). The preparation of operational patent and exploitation strategies has been taken up in the performance agreements of the universities. A National IP Contact Point has been nominated in the BMWF and became operational in spring 2010 (BMWF 2010).

6. Enhance knowledge circulation across Europe and beyond

In terms of cross-border knowledge circulation, Austrian participation in the European Framework Programme for RTD (FP) is of particular importance. Austria also makes extensive use of ERA instruments, especially ERA-NETs and JPIs, to advance cross-border knowledge circulation. International ERA-NETs and INCO-NETs are also employed for this purpose in a wider geographical dimension. A strong neighbourhood orientation has been fostered through numerous unilateral and bilateral instruments applied by Austria during the last 20 years (Schuch, 2008). However, these are being gradually abolished. A result of the manifold connections of Austria with its neighbouring countries has also been a noticeable influx of researchers and students from Central and Southeast Europe to Austrian HEI and research organisations during the last two decades.

Cross-border R&D cooperation at the regional level of Austria’s provinces is rather an exception. The CENTROPE region (a cross-border regional network including the cities of Vienna, Bratislava, Brno and Gyor) includes some R&D elements, and Styria also explicitly supports R&D cooperation with Slovenia as well as Croatia and other Western Balkan countries. Many of the regionally supported projects make use of the Transnational Territorial Cooperation Programmes supported by the SF (Schuch, 2011).

All major Austrian research funding organisations are signatories to the ‘Berlin Declaration’ issued by the Max Planck Society for the Advancement of Science, which is a most comprehensive multilateral agreement on upholding and promoting open access to research outputs and data. In addition, the Austrian Science Fund has its own open access policy, observance of which is a condition of contract for all grant holders (ERALAW 2011).

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

The fragmentation of the Austrian science, technology and innovation system does not stop at international R&D cooperation. By now, there is no shared internationalisation strategy. An effective international cooperation strategy would require long-term commitment, less ad-hocery, and a new strategic and institutionalised approach in terms of partnering, instruments and funding (Schuch, 2008). At present,

however, the internationalisation portfolio in Austria, which is broad in number of instruments⁶³, but highly sub-critical in scale, scope and financial resource endowment, is confronted with downsizing rather than experiencing the necessary enlargement. Given the anticipated budget cuts, it seems that the attempts of the last years to bring internationalisation to the top of the political S&T agenda in Austria and to invest in strategy making and strategy implementation on many different levels, have come to a halt (Schuch. 2010).

Due to the integration of many of Austria's neighbouring countries into the EU, the former predominant internationalisation focus of Austria on these countries through unilateral or bilateral measures has clearly shifted. The initially diversified ASO-network, for instance, had to close its last office in Ljubljana (Slovenia) by 31 December 2012. A growing emphasis on emerging countries, especially Russia, India and China, can be identified.

Austria has intergovernmental bilateral S&T agreements with Argentina, Bulgaria, China, Croatia, the Czech Republic, France, FYR of Macedonia, Hungary, Korea, Montenegro, Poland, the Russian Federation, Romania, Slovakia, Slovenia, Spain, UK and Ukraine⁶⁴. The agreements are usually not, or only very roughly, thematically defined and encourage a bottom-up approach.

The Austrian R&D instruments to support transnational R&D cooperation are by tradition not oriented towards grand challenges, but are usually based on thematically open bottom-up approaches. An exception to this rule is Austria's participation in the "European Collaborative Research Programmes" (EUROCORES), i.e. the thematic research programmes of the ESF. However, this mostly concerns R&D cooperation within Europe. Thematic priorities are defined within the international ERA-NETs, in which grand challenges can be addressed (e.g. KORANET call for proposals on "Research for life-long health" in 2010).

⁶³ Austria makes use of manifold instruments, measures, programmes and initiatives to support international cooperation. These comprise research and research mobility funding, maintenance of a few Austrian liaison offices in third countries, engagement in political initiatives and support to substantial international networks with a high Austrian push factor, as well as participation in relevant European networks to support the S&T dialogue with third countries. A dedicated focus of most of these instruments on grand challenges cannot be ascertained.

⁶⁴ <http://www.oead.at/wtz>, accessed on 3 February 2012

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List of Abbreviations

ABA	Austrian Business Agency
ACR	Austrian Cooperative Research
AIT	Austrian Institute of Technology
AQA	Austrian Agency for Quality Assurance
ASO	Austrian Science and Research Liaison Offices
AWS	Austria Business Service
BBMRI	Biobanking and Biomolecular Resources Research Infrastructure
BERD	Business Expenditure for Research and Development
BES	Business Enterprise Sector
BMBWK	Former Austrian Federal Ministry of Education, Science and Culture
BMLFUW	Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management
BMUKK	Austrian Federal Ministry for Education, Arts and Culture
BMVIT	Austrian Federal Ministry of Transport, Innovation and Technology
BMWF	Austrian Federal Ministry of Science and Research
BMWFJ	Austrian Federal Ministry of Economy, Family and Youth
BRIC	Brazil, Russia, India, China
B-VG	Austrian Federal Constitution Act
CDG	Christian Doppler Research Society
CEE	Central and Eastern Europe
CENTROPE	Central European Region Platform
CERN	European Organisation for Nuclear Research
CESSDA	Council of European Social Science Data Archives
CIR-CE	Cooperation in Innovation and Research with Central and Eastern Europe Programme
CISM	Centre International des Sciences Mécaniques
CLARIN	Common Language Resources and Technology Infrastructure
COIN	Cooperation and Innovation Programme
COMET	Competence Centres for Excellent Technologies
COST	European Cooperation in Science and Technology
D-A-CH	Germany, Austria and Switzerland
	German Research Foundation
ECRIN	European Clinical Research Infrastructure Network
ELETTRA	International multidisciplinary laboratory specialised in synchrotron radiation
EMBO	European Molecular Biology Organisation
EMRP	European Metrology Research and Development Programme
ENIAC	European Nanoelectronics Initiative Advisory Council
ENQA	European Association for Quality Assurance in Higher Education
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund

ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
ESRF	European Synchrotron Radiation Facility
EU	European Union
EU	European Union
EU-27	European Union including 27 Member States
EU-27	European Union including the 27 member states
EUROCORES	European Collaborative Research Programmes
FAFB	Food, Agriculture, Fisheries and Biotechnology
FAIR	Facility for Antiproton and Ion Research
FDI	Foreign Direct Investments
FEMTECH / FFORTE	Women in Research and Technology Programme
FFG	Austrian Research Promotion Agency
FP	European Framework Programme for Research and Technology Development
FP	Framework Programme
FP7	7th Framework Programme
FTE	Full-time Equivalent
FWF	Austrian Science Fund
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher Education Institutions
HERD	Higher Education Expenditure on R&D
HES	Higher Education Sector
HRST	Human Resources in Science and Technology
ICT	Information and Communication Technologies
IHS	Institute of Advanced Studies
IIASA	Institute for Applied Systems Analysis
ILL	Institut Laue-Langevin
INQAAHE	International Network for Quality Assurance in Agencies
IP	Intellectual Property
IPR	Intellectual Property Rights
ISTA	Institute of Science and Technology Austria
ISTC	International Science and Technology Centre
IUS	Innovation Union Scoreboard
JITU	Young, Innovation and Technology Oriented Companies Programme
JTI	Joint Technology Initiative
KORANET	Korean Scientific Cooperation with the European Research Area
MINT	Mathematics, Informatics, Natural Sciences and Technology (initiative to promote the enrolment of students in these subjects)
MORE	Mobility of Researchers
NMP	Nanosciences, Nanotechnologies, Materials and New Production

	Technologies
NOW	Netherlands Organisation for Scientific Research
ÖAW	Austrian Academy of Sciences
OeAD	Austrian Agency for International Cooperation in Education and Research
OECD	Organisation for Economic Co-operation and Development
PhD	philosophiae doctor
PISA	Programme for International Student Assessment
PPP	Public-private Partnership
PRACE	Partnership for Advance Computing in Europe
PRO	Public Research Organisations
R&D	Research and Development
RI	Research Infrastructures
RTDI	Research, Technological Development and Innovation
S&E	Science and Engineering
S&T	Science and Technology
SF	Structural Funds
SHARE	Survey of Health, Ageing and Retirement in Europe
SME	Small and Medium Sized Enterprise
SNF	Swiss National Science Foundation
STCU	Science and Technology Centre Ukraine
STE	Science, Technology and Engineering
TC	TrendChart
VC	Venture Capital
VCI	Venture Capital Investment
WIFO	Austrian Institute of Economic Research
WMO	World Meteorological Organisation
ZSI	Centre for Social Innovation

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Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.



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